JUNE 1961

Precision Metal Molding

INCLUDING DIE CASTINGS

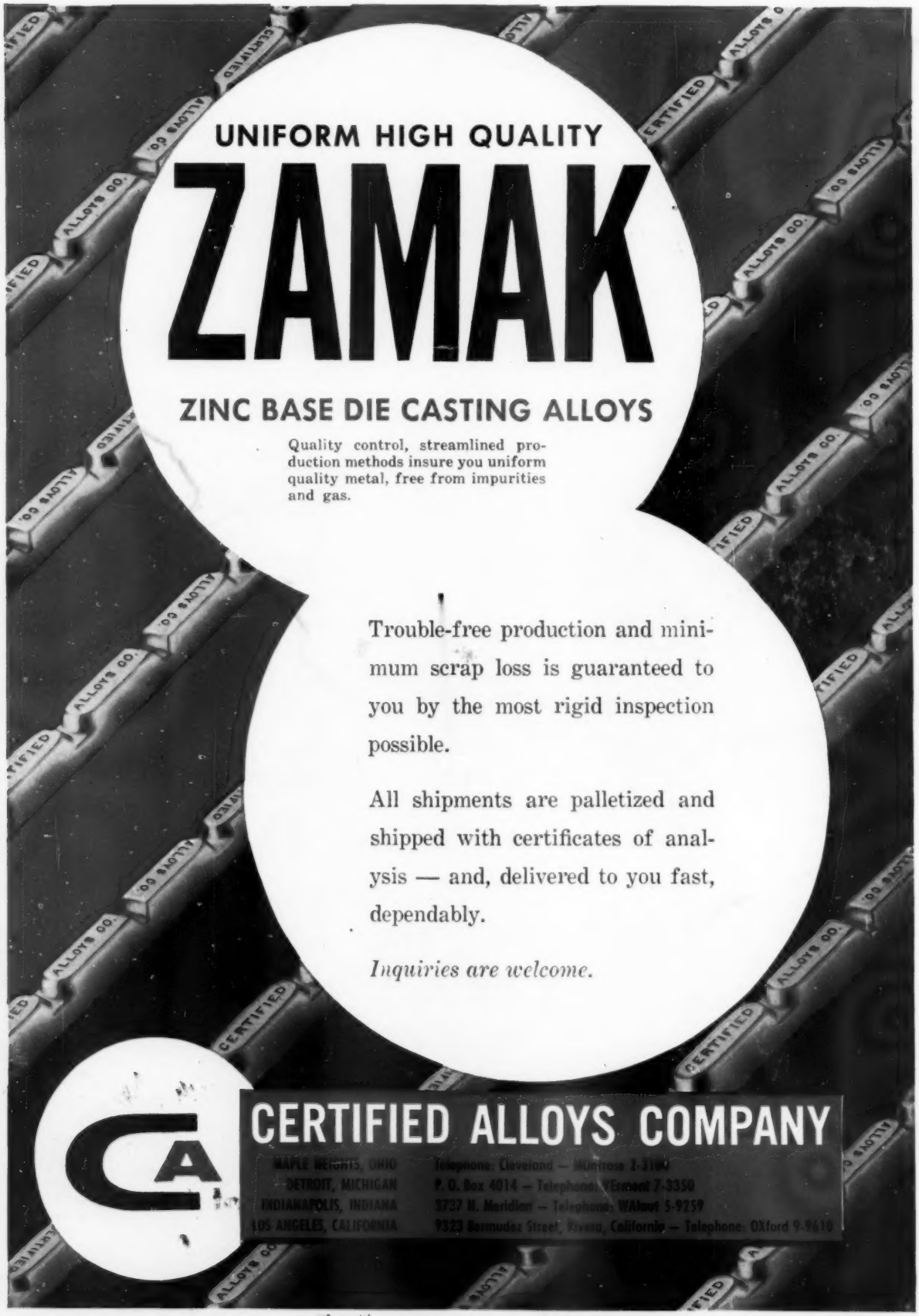
Zinc Die Castings Foil Yeggs

6th Annual
DIRECTORY
of Investment
Casting
Industry

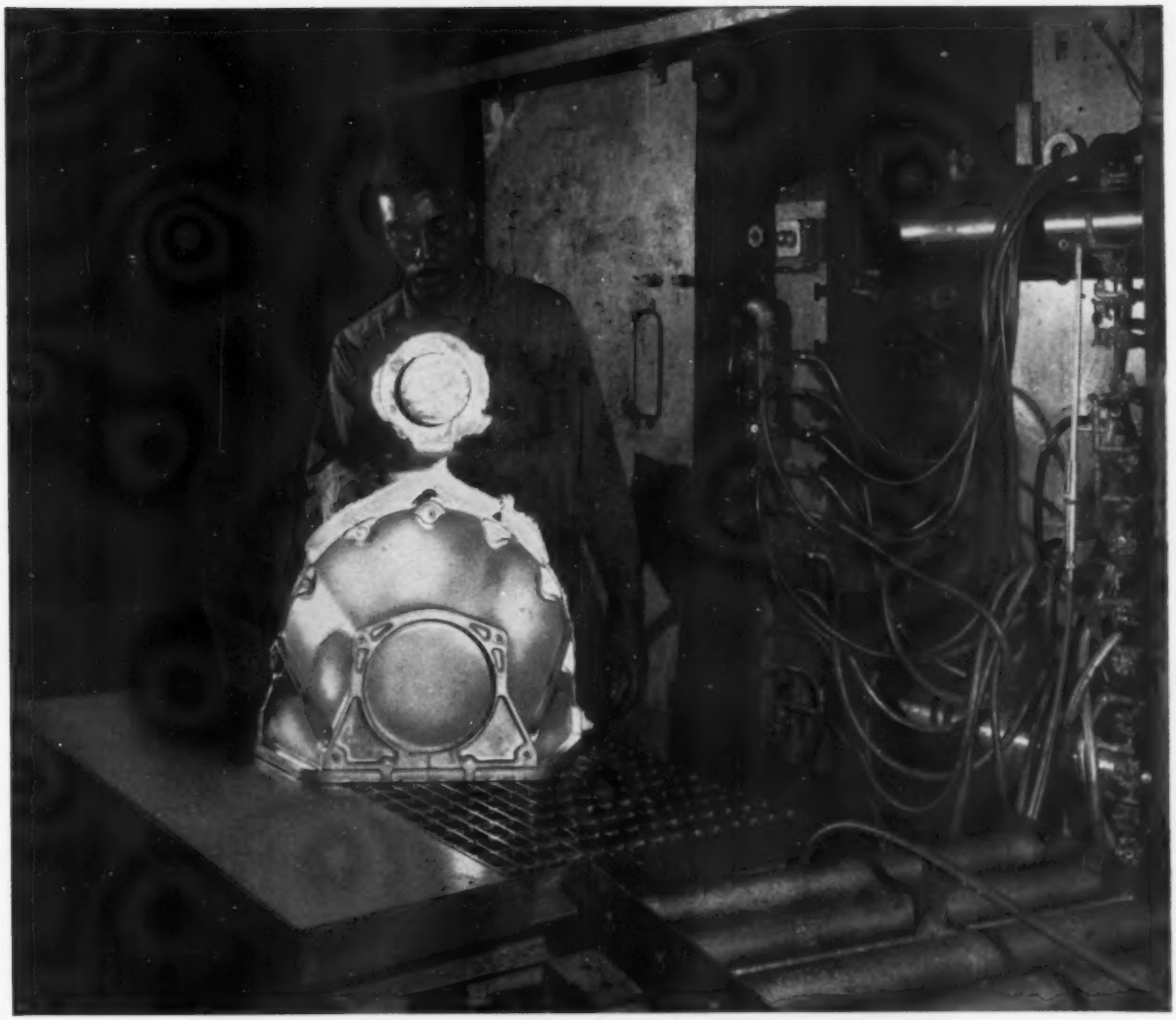
UNIVERSITY MICROFILMS
313 N. FIRST ST

PMM

PLASTER MOLD CASTINGS • INVESTMENT CASTINGS
PERMANENT MOLD CASTINGS • DIE CASTINGS
POWDER METALLURGY PARTS • EXTRUSIONS


UNIFORM HIGH QUALITY
ZAMAK
ZINC BASE DIE CASTING ALLOYS
Quality control, streamlined production methods insure you uniform quality metal, free from impurities and gas.
Trouble-free production and minimum scrap loss is guaranteed to you by the most rigid inspection possible.
All shipments are palletized and shipped with certificates of analysis — and, delivered to you fast, dependably.
Inquiries are welcome.
CA
CERTIFIED ALLOYS COMPANY
MAPLE HEIGHTS, OHIO
DETROIT, MICHIGAN
INDIANAPOLIS, INDIANA
LOS ANGELES, CALIFORNIA
Telephone: Cleveland — MOnroe 1-3180
P. O. Box 4014 — Telephone: VErmont 7-3350
3737 N. Meridian — Telephone: WAlnut 5-9259
9323 Bermudez Street, Rivera, California — Telephone: OXford 9-9610

Circle No. 20 on Reader Service Card



1000-ton Cast-Master at Chrysler's Die Casting Plant, Kokomo, Indiana, produces 21 lb. torque converter housings.

Automotive Trend:

EVERYTHING'S SMALLER BUT THE DIE CASTINGS

It's a significant balance. Die castings get bigger as economic considerations put top priority on low cost die casting production. Complicated assemblies are unit cast in one operation. Parts are lighter, rust free, easier to machine, easier to produce, less costly.

Cast-Master die casting machines have met many of these new challenges in a line that fills every need from a few ounces to 85 lbs. From tiny carburetor part to engine block, Cast-Master has the machines; machines with interchangeable injection ends for hot or cold chamber casting, positive mechanical mold clamping, fast hydraulic injection principles.

If you're ready for die casting, standardize with Cast-Masters, the machines you can count on for more profit, more dependable production. Want to test a new product mold? Write Cast-Master for details on their Lab Test Program.

H115

H-P-M DIVISION - KOEHRING COMPANY

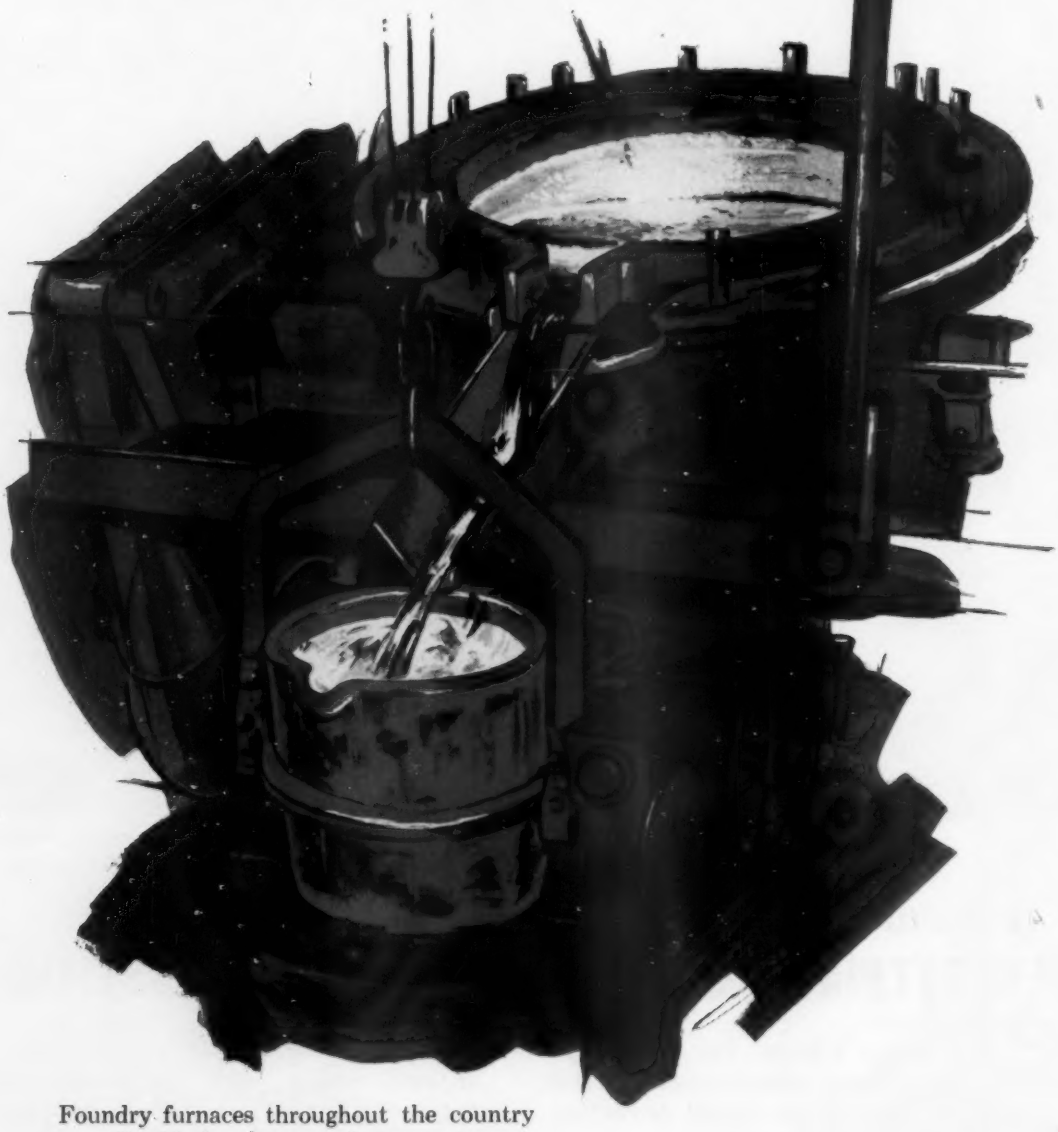
CAST-MASTER

23901 AURORA ROAD, BEDFORD, OHIO

Circle No. **37** on Reader Service Card

A L M QUALITY CONTROL

of your specific alloy...



Foundry furnaces throughout the country pour liquid aluminum made to exact specification by A & M. Rigid quality-control guarantees the high standard of product that has made A & M a leader for over 20 years. Be sure your products are made from the best basic alloy—A & M.

Producers of Quality Aluminum Alloy Since 1938

ALUMINUM and MAGNESIUM, INC.

1 HURON STREET • P.O. BOX 720 • SANDUSKY, OHIO • TELEPHONE: MAin 6-4610

P.O. BOX 156 • Corona, California • Telephone: REdwood 7-2922

Circle No. 4 on Reader Service Card

PMM in this issue

June, 1961: Volume 19 Number 6

FEATURE ARTICLES

23 MUST YOU MACHINE THAT PART?
By switching to zinc die castings, one manufacturer saved 75% of former costs by eliminating machining operations.

24 DESIGNING FOR POWDER METALLURGY
In this second article of a series, T. L. Robinson begins a discussion on why, where and when to use powder metal gears.

27 COPPER-BASE EXTRUSIONS
This second part continues the design tips for ordering and specifying extrusions in copper-base alloys.

31 ETHYL SILICATE BINDER FOR INVESTMENT MOLDS
Low costs and reduced fire hazards are two good reasons for using an ethyl silicate binder.

34 ZINC DIE CASTINGS FOIL YEGGS
A burglar proof Sargent and Greenleaf lock is made of zinc die castings and extruded parts.

39 GATING ZINC DIE CASTINGS
The gating of circular and tubular zinc die castings is discussed in this second article.

42 BRASS GEARS AND CAMS WIN 1961 PRIZE
Here are the 1961 New Jersey Zinc Co. Non-Ferrous Powder Metal Parts contest winning parts.

44 ALLOY "713C" HAS GOOD PROPERTIES TO 1800°F.
Nickel base alloy use has been extended to higher operating temperatures thanks to the new 713C alloy.

56 POWDER METALLURGY LITERATURE FROM THE 1961 M.P.I.F. SHOW

58 AN INDUSTRY RESEARCHES FOR A BETTER PRODUCT
Investment Casting Institute members have combined forces to develop new products and techniques.

69 CRITERIA FOR USING INVESTMENT CASTINGS
At the design stage when operational requirements are satisfied, it might be wise to consider investment casting the part because of metal choice, tolerances and configuration.

FINISHING SECTION

47 MACHINING AND SURFACE FINISHING EXTRUSIONS
Here's how one supplier of extrusions has expanded to help the manufacturer keep finished parts costs down.

DIRECTORY SECTION

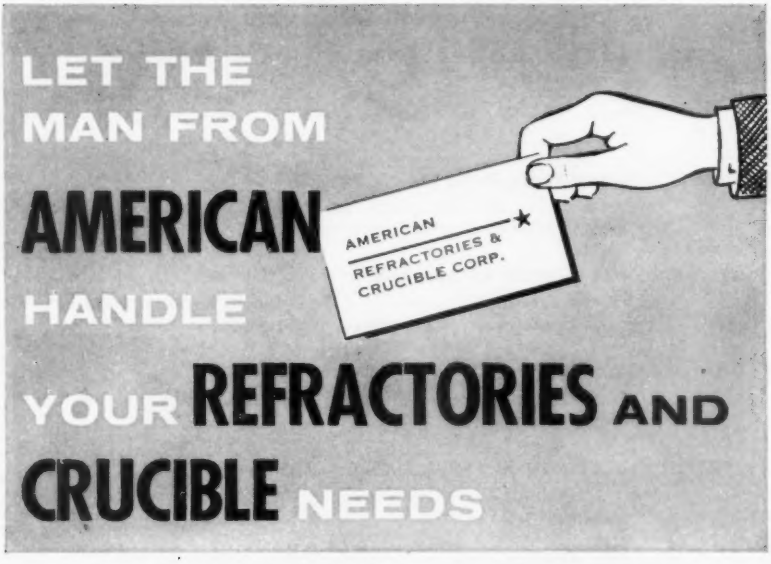
73 6th ANNUAL INVESTMENT CASTING DIRECTORY

73 Investment Castings
86 Equipment
95 Materials
97 Metals & Alloys

DEPARTMENTS

10 Casting About
15 New Products
18 Letters
21 Industry News
53 Data in Ads
61 Useful Literature
99 Opportunities

Published monthly, copyright 1961 by
THE INDUSTRIAL PUBLISHING CORP.



He is specially trained and has the engineering background to use a whole family of American Refractories and Crucible products to help solve your molten metals handling problems. Let him prove to you how American products will . . . IMPROVE YOUR PRODUCTION — LOWER COSTS — LAST LONGER.

★ **STARRBIDE CRUCIBLES** . . . with carbon bonded "thin wall" construction gives you *more metal per heat; more heats per furnace;* and use *less fuel per pound of metal.*

★ **STARR BASEBLOCKS** . . . to fit any crucible and furnace are readily available from American.

★ **STARRLUM SUPER-REFRACTORY CEMENTS** . . . meet all refractory requirements under all plant conditions!

★ **STARR RAMMING & PATCHING MIXES** . . . Nine mullite or alumina-based mixes provide an answer to every need.

★ **SPECIAL POURING TROUGHS, SKIMMERS, SHAPES, ETC** . . . are another part of American's regular service to you.

★ **STARRBIDE SLAG HOLE BLOCKS** . . . reduce shut downs because they last longer!

★ **BONNETT STOPPER HEADS** . . . feature patented assembly details to improve your operations and reduce costs.

ENGINEERING LABORATORY SERVICES

Technical assistance in the use and installation of crucibles and all kinds of refractory materials is a new, improved service available through The Man From American. In the field and in our laboratory, engineers and production experts are prepared to work with you in every way to help improve your metals melting and pouring operations.

GOT A PROBLEM? TELL IT TO THE MAN FROM . . .

AMERICAN REFRACTORIES & CRUCIBLE CORPORATION

North Haven • Connecticut

Circle No. 6 on Reader Service Card

Precision Metal Molding

STAFF

David W. Veit . . . . . *publishing director*
Philip R. Kalischer . . . . . *editor*
Ronald Khol . . . . . *associate editor*
Robert K. Mueller . . . . . *assistant editor*
Scholer Bangs . . . . . *western editor*
672 So. Lafayette Park Pl.
Los Angeles 57, California
Henry Lefer . . . . . *eastern editor*
Rm. 835, 60 E. 42 St.
New York 17, N. Y.
H. K. Barton . . . . . *foreign editor*
Hiram Barton Associates
Roughfield, Etchingham
Sussex, England
Bert Benkendorf . . . . . *art editor*
Mary A. Cindrich . . . . *editorial assistant*

SERVICE DEPARTMENTS

Alaric Mausser . . . . . *art director*
N. G. Kiser . . . . . *circulation manager*
Robert Gauvin *mgr. reader service dept.*

SALES OFFICES

Cleveland 15
812 Huron Rd., SU 1-9620
ROBERT SIMMONS

New York City 17
Rm. 835, 60 E. 42 St., MU 7-3420
LEE HAAS, *manager*
ARTHUR L. GOEBEL

Chicago 11
Rm. 704, 520 N. Michigan,
WH 3-1655
CHARLES F. GEYER, *manager*
KENNETH L. JONES

Los Angeles 57
672 S. Lafayette Park Pl.,
DU 7-5104
ALAN T. CAZIER, *manager*
LLOYD BROOKMYER

London, S.W. 1, England
36 Victoria Street,
Sullivan 6072
JOHN A. LANKESTER, *manager*

SUBSCRIPTIONS in U.S. and possessions: $7. 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £ 3.5.0 per year payable in Sterling to London office. Single copies when available: 1 to 10 — $1.00 each; 11 to 25 85¢ each; over 25 75¢ each.

Out of print copies of PRECISION METAL MOLDING are available in complete volumes as positive microfilm copies from University Microfilms, 313 N. First St., Ann Arbor, Mich.

published monthly by
The INDUSTRIAL PUBLISHING CORPORATION
812 Huron Rd., Cleveland 15, Ohio

LESTER P. AURBACH . . . . . *president*
EDWIN M. JOSEPH . . . . *executive v. p.*
PAUL ROLNICK . . . . . *vice president*
N. N. GOODMAN, JR. . . . *vice president*
LEE HAAS . . . . . *vice president*
CHARLES F. GEYER . . . . *vice president*
THOMAS L. DEMPSEY . . *asst. sect.-treas.*

AFFILIATED PUBLICATIONS: Hydraulics & Pneumatics, The Refrigeration & Airconditioning Business, Material Handling Engineering, Handling & Shipping, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication. Member BPA.

Accepted as a controlled circulation publication at St. Joseph, Michigan. Not responsible for unsolicited editorial material. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio. Printed in the U.S.A.

50-lb. ingot

25-lb. ingot

10-lb. ingot

Casting? Call Olin.

Olin Aluminum distributors carry a wide range of casting alloys in immediately available stock from the 10-lb. ingot to the exclusive 25-lb. ingot and the 50-lb. ingot. Olin Aluminum sales offices and distributors also offer you a full range of technical service backed by Olin's metallurgical staff and laboratories. This service includes help in metal selection and application advice, tips on casting and finishing aluminum. Why not make Olin Aluminum your source of primary casting alloys—and the latest metallurgical know-how. Call your local Olin Aluminum distributor or nearby sales office and get experienced help on any of your foundry problems.

Olin
ALUMINUM
400 PARK AVE., NEW YORK 22, NEW YORK

Circle No. 51 on Reader Service Card

NEW 15-MINUTE X-RAY OF AN ALLOY MEANS STILL HIGHER QUALITY...

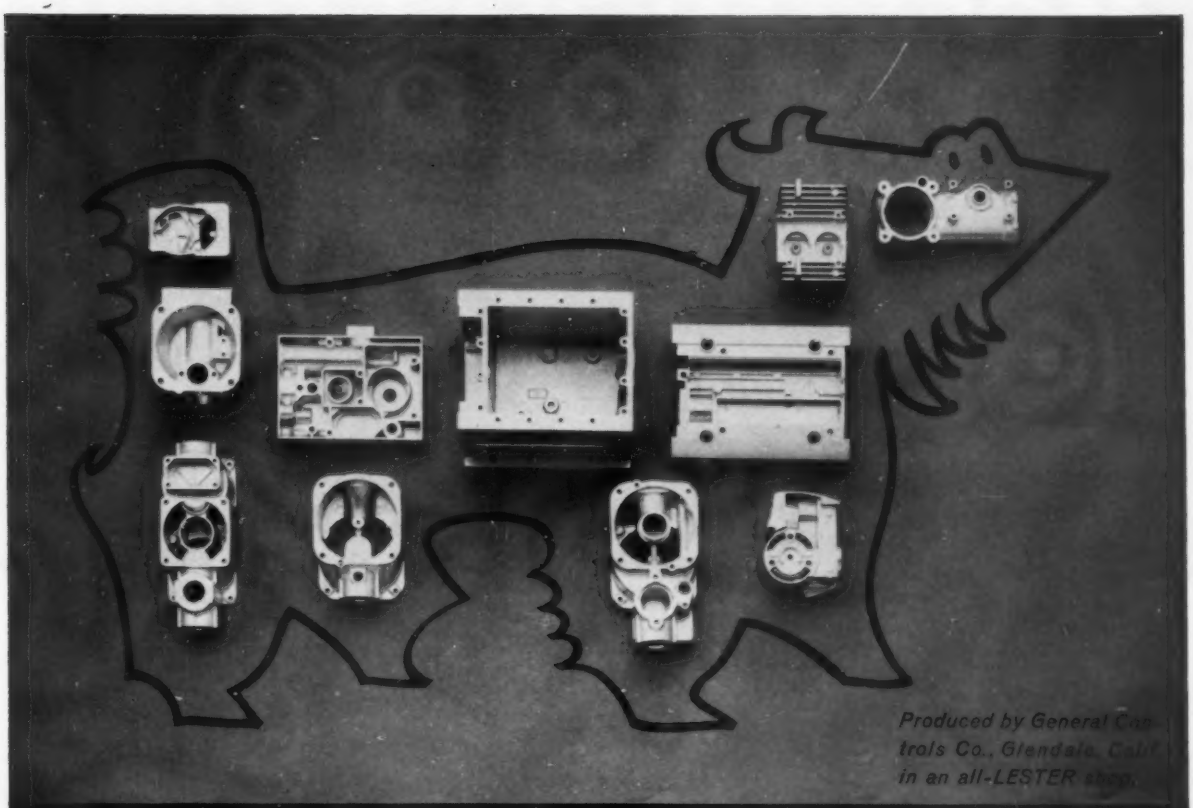
STILL FASTER SERVICE FROM C-M. HERE'S THE RESULT OF A GREAT NEW ADVANCE IN QUALITY CONTROL—A COMPLETE ALLOY ANALYSIS ON PRINTED TAPE OBTAINED WITH THE UNIQUE NEW X-RAY SPECTROGRAPHIC PROCESS. THIS NEW METHOD BENEFITS YOU TWO IMPORTANT WAYS: FIRST, IT MAKES ALLOY ANALYSIS MORE ACCURATE THAN EVER BEFORE . . . WHICH MEANS ADDED CERTAINTY THAT YOUR ALLOYS ADHERE RIGIDLY TO QUALITY SPECIFICATIONS. ALSO, THIS NEW X-RAY PROCESS MAKES THE COMPLETE ANALYSIS IN JUST 15 MINUTES INSTEAD OF 3 DAYS. TOTAL RESULT: STILL HIGHER QUALITY, BETTER SERVICE, FASTER DELIVERY. A POST CARD BRINGS FULL INFORMATION.

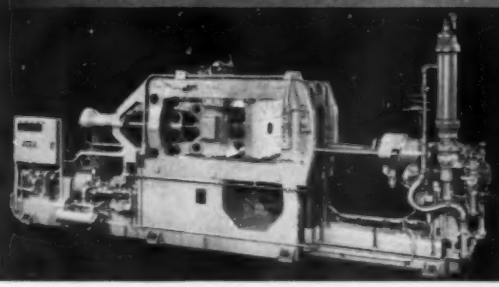
ULTRA MET
VACUUM ALLOYS

CANNON-MUSKEGON CORPORATION

METALLURGICAL SPECIALISTS • 2871 LINCOLN STREET • MUSKEGON, MICHIGAN
PRODUCERS OF IRON, NICKEL AND COBALT ALLOYS: SHEET, WIRE, BAR, FORGINGS, INGOTS, SHOT

Circle No. **15** on Reader Service Card





THESE DIE CASTINGS ARE A DIFFERENT BREED OF ANIMAL

The aluminum die castings pictured above may *look like* typical die castings. They are, in fact, a different breed, because they are used to do a job that ordinary die castings *can't* do. As control parts for gas and oil appliances, they must withstand test pressures as high as 300 PSI in some cases. These are PRESSURE-TIGHT CASTINGS!

These die castings are concrete evidence of the special values built into Lester Die Casting Machines. Wilf Botfield, Master Mechanic at General Controls Co. in Glendale, California, where these parts are produced, says: "We couldn't produce this kind of casting except for the absolutely square lock-up of the Lesters. Any flash and the interlocking cores would be plugged solid with metal. And we can't put up with any "normal blow-back"... it would ruin critical dimensions (±.003" to .005"), waste metal and complicate our trimming. For a steady run of flash-free, leakproof parts with the detail and finish we require, nothing beats a Lester."

Yet despite these demands—and on relatively small parts—General Controls consumes more metal in their all-Lester shop, than die casters with many more machine units. With the CERTIFIED CLAMP of a Lester machine, you, too, can end the problems of flash, freezing and die failure and start getting pressure-tight parts, because every square inch of the Lester platen is clamping *evenly*, to give the full rated tonnage! Write for Bulletin 102.

LESTER-PHOENIX, INC.
2708-J CHURCH AVENUE • CLEVELAND 13, OHIO
Agents in principal cities throughout the world

Circle No. 43 on Reader Service Card

A MOST EFFICIENT SERVICE

WITH THE MEN, MACHINES, EQUIPMENT and EXPERIENCE TO MEET YOUR EXACTING DIE CAST and MOLD-MAKING REQUIREMENTS

Service in LARGE SIZE Never Before Offered by Any Die Cast Die and Mold Manufacturer

Here is a dependable, experienced large organization ready to work with you—in design, engineering and building the finest Die Cast Dies and Permanent Molds—from medium to the largest sizes. Consult us, or inspect our two complete plants with the most modern facilities. Your request for information will receive prompt, courteous attention.

OUTSTANDING FACILITIES

KELLERS—HYDROTELS: Up to 6′ x 12′, 11 Units

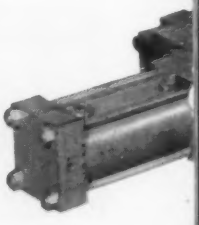
BORING MILLS: Up to 7′ x 12′ Range, 9 Units

COMPLETE DESIGN AND ENGINEERING DEPT.

FULLY EQUIPPED MODEL AND PATTERN SHOP

CRANE CAPACITY UP TO 30 TON

PRODUCTION FLOOR SPACE 63,000 SQ. FT.



EFFICIENT TOOLING

DIE CAST TOOLING DIVISION OF

THE EFFICIENT TOOL & DIE CO.

9314 ELIZABETH AVENUE • CLEVELAND 5, OHIO

Phone: Diamond 1-5150

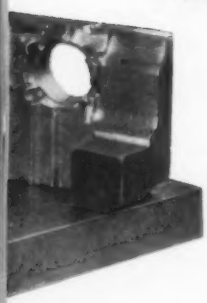
. . . DIE CAST TOOLING

A Division of THE **EFFICIENT** TOOL & DIE CO.

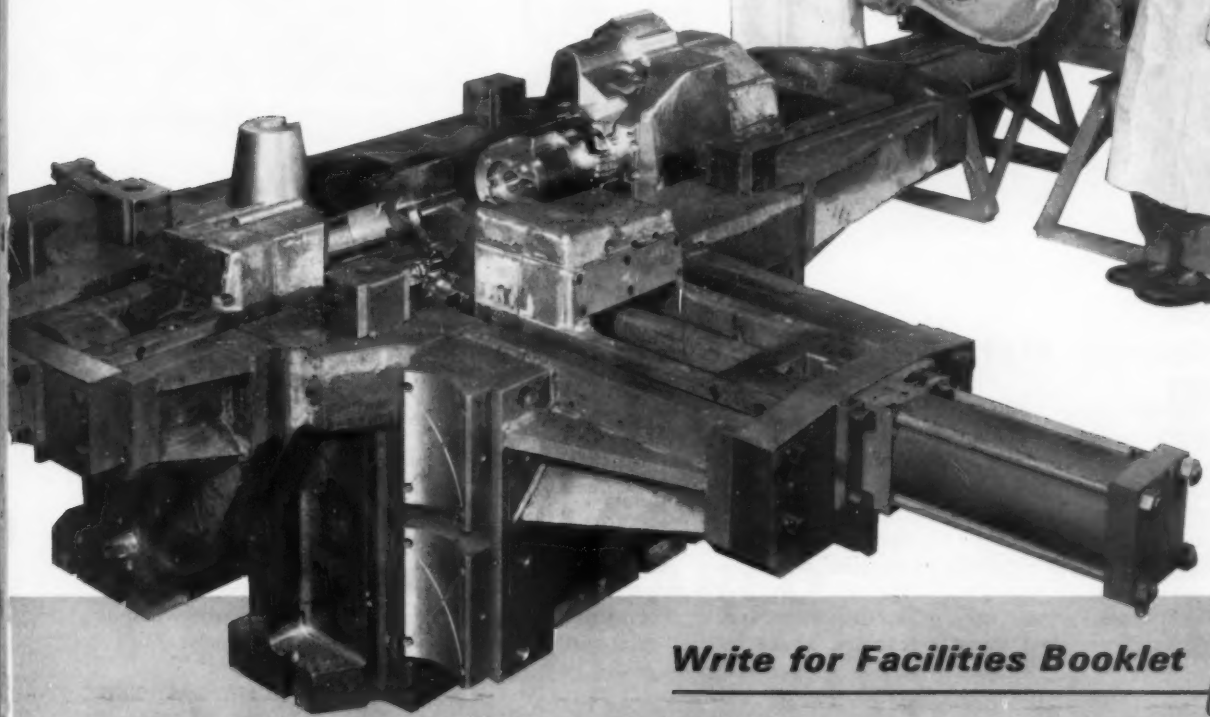
Designers and Manufacturers of

- **Medium and Large Die Cast Dies**
- **Die Cast Trim Dies**
- **Plastic Molds**
- **Permanent Molds**
- **Fiber Glass Molds**
- **Models and Duplicating Aids**

(Testing Facilities)



The rather large casting shown is a transmission housing and was produced in the die illustrated. This gives further evidence of the wide range of complex, as well as simpler work done with Efficient's superior facilities.



Write for Facilities Booklet

Circle No. 28 on Reader Service Card

PMM

casting about *technical news of applications & processes involving precision metal molding*

Simulated Die Castings May Lower Design Development Costs

Product planners and designers can now have small quantities of simulated die castings without the high cost of permanent die casting tooling.

The Newton-New Haven Company has developed a low cost, low-volume, casting method said to produce parts which look, feel, finish, and perform like production die castings. This eliminates the investment in production dies during preliminary die casting design and keeps die development costs low.

Use of this prototype service is expected to aid in test marketing limited quantities of products using die castings, and to help engineers in evaluating the characteristics of the products. The service is also expected to make early desgin errors less costly.

Experimental Cars Use Aluminum Trim and Body Material

This retractable hardtop convertible is one of three experimental "Scimitar" automobiles built for Olin Mathieson Chemical Corporation as part of a research program to develop new uses for aluminum. The convertible has anodized aluminum quarter panels, grille, bumpers, trim, wheel discs, and other components. Many interior fixtures are brushed and anodized aluminum.

The two other cars are a town car hardtop phaeton with telescoping roof and a station "sedan" that combines the qualities of a station wagon and family sedan. All three make extensive use of aluminum body material.

The cars are built on standard Chrysler New Yorker chassis. They were designed for Olin by Brooks Stevens Associates.

The cars were exhibited briefly in Europe when they were built two years ago. But since then they have been under wraps and used only for research.

Powder Metallurgy Has Role in Nuclear Aircraft Power

Powder metallurgy techniques are playing an important role in the development of General Electric Company's aircraft nuclear power propulsion system. Fabrication of concentric ring fuel elements involve all common and some unique powder metallurgy processes. Fuel billets used in the system incorporate the fuel material with a protective powder of nickel-chromium alloy.

The propulsion system uses oxide dispersion fuel elements to power heat transfer reactors. These reactors, in turn, operate turbojet engines.

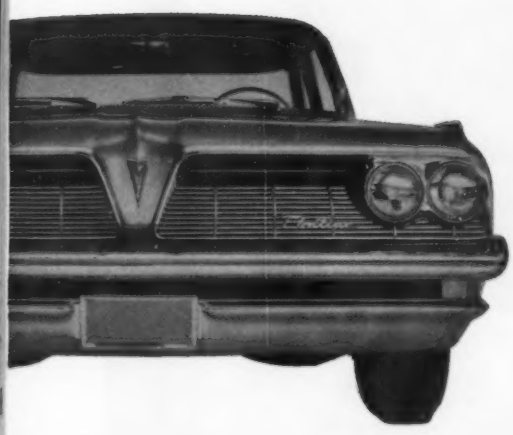
A complete prototype propulsion system has operated for over 150 hours. The development program has included about 1000 hours of reactor operation, 4,300 hours of nuclear testing, and 45,000 hours of non-nuclear tests.

Aircraft with nuclear propulsion systems are expected to be capable of staying airborne for months at a time. On the other hand, critics doubt whether such craft are worth the money they will cost.

ASARCO ZINC DIE CAST ALLOYS

For Trouble-Free Die Casting

Specify Asarco Zinc Alloy

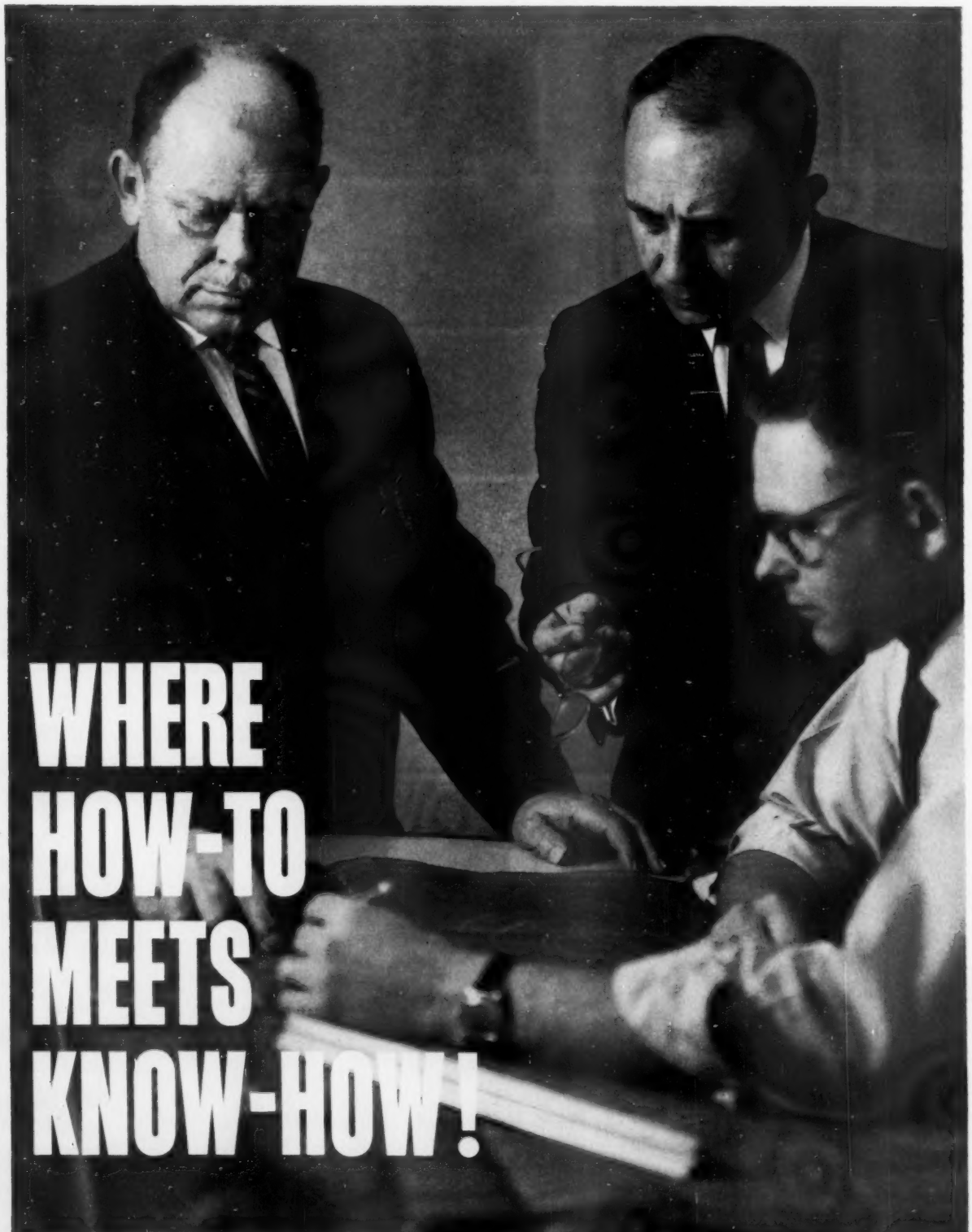


When the job calls for zinc die castings to meet high standards of product quality, use Asarco zinc die cast metal. It is made from Special High Grade Zinc, 99.99+% pure, the world's purest metal produced in large tonnages. Its purity and uniformity, unsurpassed anywhere, are assured by Asarco-developed electrolytic refining processes and by completely controlled alloying techniques. Asarco Zinc Die Cast Alloys numbers 3, 5 and 7, sold by the Federated Metals Division, are ready for immediate shipment from stock in seven convenient supply centers across the country. With Asarco Zinc die casting alloys you get low material cost, superior impact strength and castability, minimum machining and finishing time, reduced production time and cost, shorter casting time, low temperature casting, smoothest casting surfaces, brilliant and lasting finishes.

For complete information, write or call Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N.Y., or your nearest Federated sales office.

ASARCO

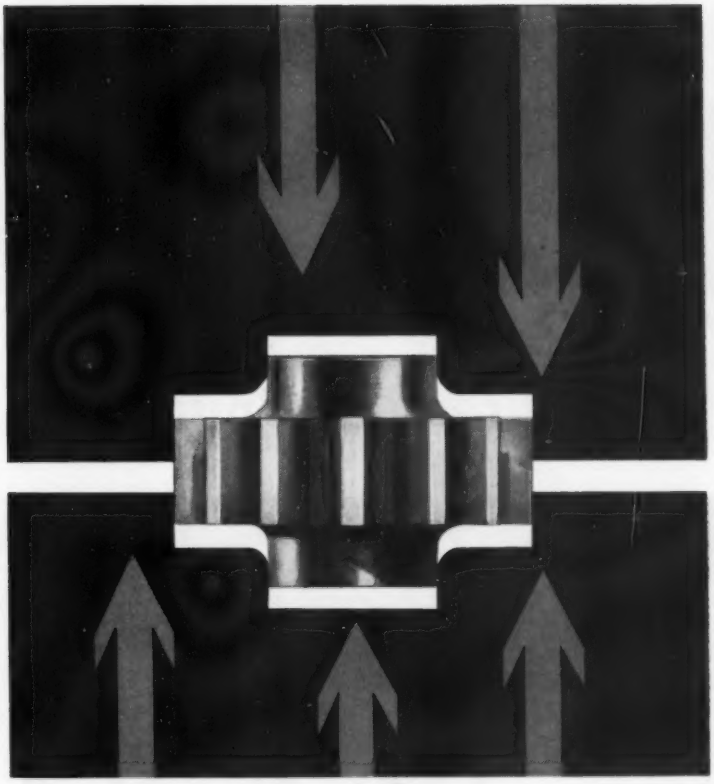
Circle No. 7 on Reader Service Card



SOUTHERN DIE CASTING

& ENGINEERING • 206 ALBERTSON RD. • HIGH POINT, NORTH CAROLINA • A DIVISION OF ADAMS-MILLIS CORP.

Circle No. 57 on Reader Service Card



most flexible

powder metal press

available!

STOKES BUILT-IN PRESS MOTIONS

trim costs of powder metal parts

This 50-ton Stokes press gives you the multiple motions you must have for complex powder metal compacting . . . *without the expense and delay of manufacturing* and setting up complex tooling for *every job.* Stokes built-in motions give highest production of even the most complicated parts.

The Model 640 Powder Metal Press provides two upper and three lower compacting motions with underfill or resistance pressing controls. By simply positioning a selector switch and sequence dials at the control panel, the third lower motion can be set up as a resistance motion, a third lower punch, or as a stationary, movable, or ejecting core rod.

All press motions are precisely indicated and controlled from the central operating position in front of the press. Single cycle control simplifies tool set-up and facilitates compacting of parts with inserts. Rigid cast box-type frame overcomes deflections common in gap frame presses. Yet it provides accessibility for tool changing not available in four post presses.

For complete technical data on Stokes Model 640 50-Ton Multiple-Motion Powder Metal Press, write for Bulletin No. 1200. For any compacting or pressing job, no matter what the material, no matter what the size or production requirements . . . you can do it faster and more economically with Stokes equipment. Consult Stokes Engineering Advisory Service for complete technical assistance in designing parts, punches and dies, or complete production facilities.

STOKES

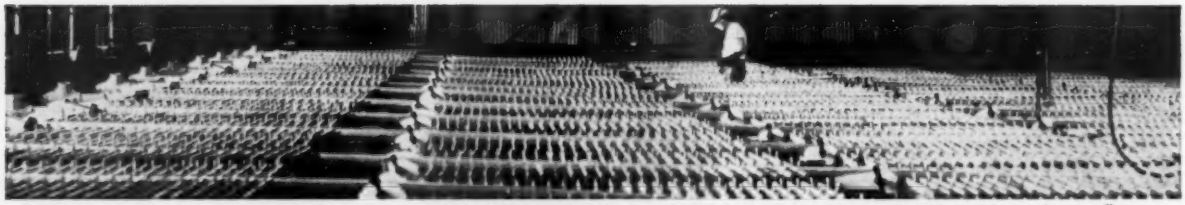
POWDER METAL PRESS DIVISION • **F. J. STOKES CORPORATION** • 5500 TABOR ROAD, PHILADELPHIA 20, PA.

Circle No. **58** on Reader Service Card

INTEGRATED PRODUCTION—from Ore to Ingot

Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of



Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

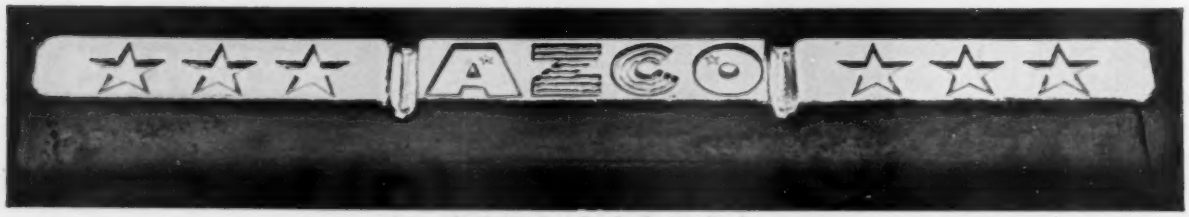
AZCO Zinc Die Cast Alloys

Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company.

1515 Paul Brown Building, St. Louis 1, Missouri
Distributors for:
AMERICAN ZINC, LEAD AND SMELTING COMPANY
Detroit • Columbus, O. • Chicago • St. Louis • New York



Circle No. 9 on Reader Service Card

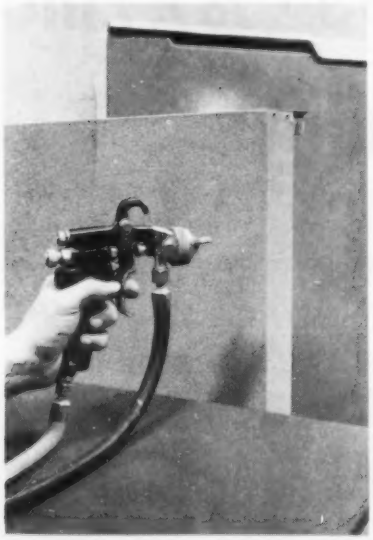
PMM

new products & developments *qualified readers can get complete details on these products. Use the reader service cards.*

Colors, textures are easily sprayed on

METAL & THERMIT CORP.—Spray-on vinyl finishes come in unlimited colors and with controllable texture. The finish can be applied to either phosphated steel or aluminum by conventional or electrostatic spray techniques.

With this finishing method, inventory problems are simplified

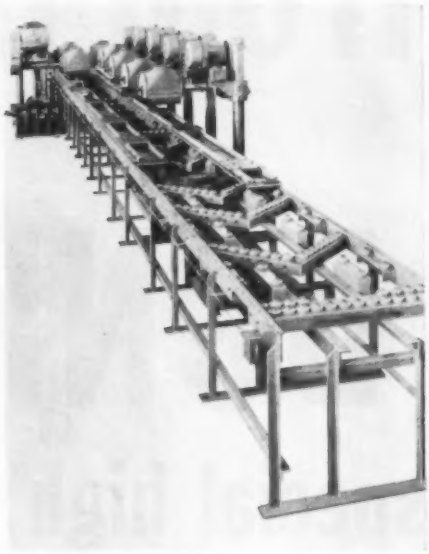


since only uncoated metal needs to be stocked. Different colors and textures are obtained by changing the vinyl spray material. Coated rejects can be stripped and resprayed.

Circle No. **236** on Reader Service Card

Get good luster on aluminum extrusions

HAMMOND MACHINERY BUILDERS, INC.—Horizontal return endless conveyor removes die lines and adds luster to extruded aluminum shapes. Conveyor platens, accommodating up to 22 ft. long extrusions, are loaded and unloaded while moving at production speed. Extrusions pass under heads arranged to provide a buff or a satin finish, as desired. Six spray compound applicators are timed and actuated electrically. Production speeds are from 9 to 27 ft. per minute.

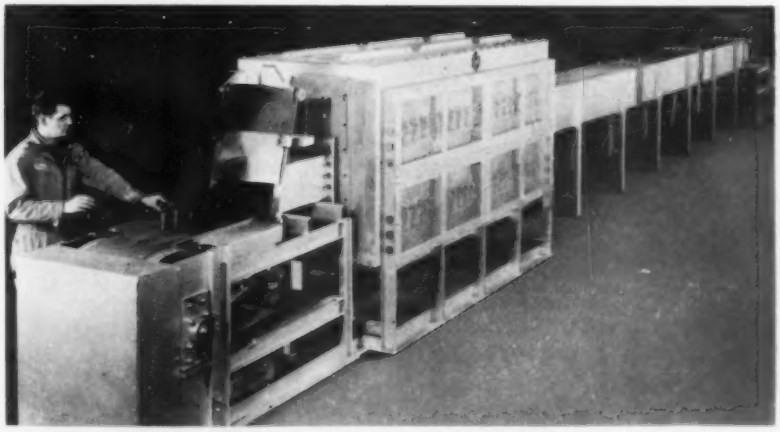


Circle No. **235** on Reader Service Card

Furnaces are designed for pure atmosphere

HARPER ELECTRIC FURNACE CORP.—Mesh Belt Furnaces have been modernized to maintain purity of atmosphere in continuous brazing, annealing, and sintering operations. The line includes 17 straight-thru type.

Materials to be treated can be light or medium weight, and in any shape. Work can be placed directly on the mesh belt conveyor, in auxiliary baskets or other type of carriers. Gas flame curtains and adjustable end doors assure low atmosphere gas consumption and minimum air infiltration. Furnaces used for sintering are normally provided with burn-off chambers ahead of the high-heat chambers.



Circle No. **237** on Reader Service Card

more New Products on page 64

Just a whisker away from five-9 purity

BUNKER HILL

special high grade (99.99+%) zinc also...zinc base alloys

The first 99.99% zinc to be available on a commercial scale bore the famous name of BUNKER HILL.

Today, this time-honored brand, available from National Lead Company, analyzes very close to five-nine purity.

It is belaboring the obvious to point out the advantages of using metal with the lowest possible percentage of impurities.

When you buy Bunker Hill Special High Grade Zinc and Zinc Base Alloys from National Lead Company, you get the benefits of high purity . . . plus the distribution advantages inherent in National Lead's nationwide network of metal stocks. Profit by these extras . . . starting now!

Write, wire or phone nearest office

National Lead Company

General Offices: 111 Broadway, New York 6, N. Y. • Branches in principal cities

Circle No. 91 on Reader Service Card

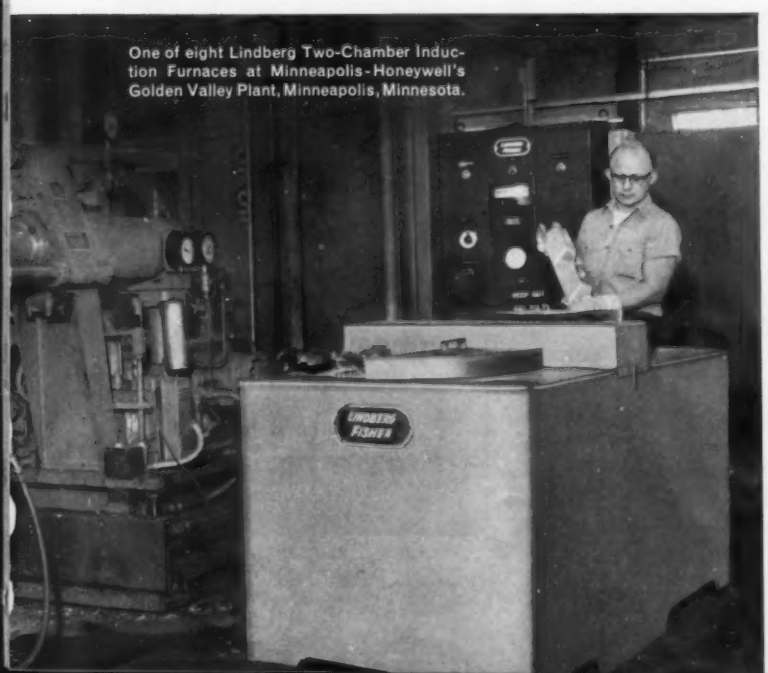
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

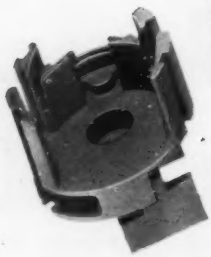
In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

Circle No. 88 on Reader Service Card

LINDBERG
heat for industry

THE FREEDOM DIMENSION



. . . is shape flexibility

The investment casting process allows a new *freedom of design* . . . in shape . . . in materials. You can now design for function—the way you want the part!

This functionally designed instrument chassis was poured as an investment casting without design compromise. Dozens of expensive and complicated machining operations would otherwise have been required. Check your design with Hitchiner—in many cases you can buy *just what you want.*

Write for complete technical and facilities information.

HITCHINER
Milford 1, New Hampshire

Circle No. 34 on Reader Service Card

PMM letters

the readers' forum

Permanent mold equipment

As producers of permanent mold castings we are interested in standard parts and equipment for permanent molds.

In the Readers' Forum of your May 1960 issue you advised one of your readers requesting similar data that you would forward him the names of some suppliers.

We would appreciate a duplicate of this list if it is available.—E.T.

The following companies are some of those supplying standard parts and equipment for permanent molds: Peerless Gear and Machinery Co., Dunkirk, Ohio; Permanent Mold Die Co., Hazel Park, Mich.; Stahl Specialty Co., Kingsville, Mo.; Standard Machine & Tool Co., Kalamazoo, Mich.—Ed.

Design article reprints

It seems that almost monthly I request reprints from you to distribute to our design staff. This time my request is for ten reprints of the article "Design with Aluminum Extrusions" from your April 1961 issue.—G.W.F., Purchasing Department

We are pleased to learn that you find the editorial material in PMM helpful to your design staff. The reprints are being shipped.—Ed.

Information on secondary aluminum

The American Die Casting Institute has suggested that you may be able to tell me where I can find information concerning secondary aluminum.—J.F.B.

Information on the secondary aluminum industry can be secured from the Aluminum Smelters Research Institute, 20 North Wacker Drive, Chicago, Ill.—Ed.

Dodge Custom-made
Special Alloy Steel Goosenecks
. . . for longer service life
. . . less maintenance

Here's the biggest news in die casting in years: a custom-made special alloy *steel* gooseneck that will outlast and outperform iron and alloy iron goosenecks currently available . . . and provide greater operational savings! Developed through years of experience and association with the die castings industry, Dodge Special Alloy *Steel* Goosenecks provide many advantages:

- Will outlast iron and alloy iron goosenecks by as much as 4-5 years.
- Maintenance problems are fewer because of long service life.
- Down time is reduced to a minimum because of long service life.
- Designed and made of special alloy *steel*, they prevent cracking . . . bottom breakout . . . spout erosion.

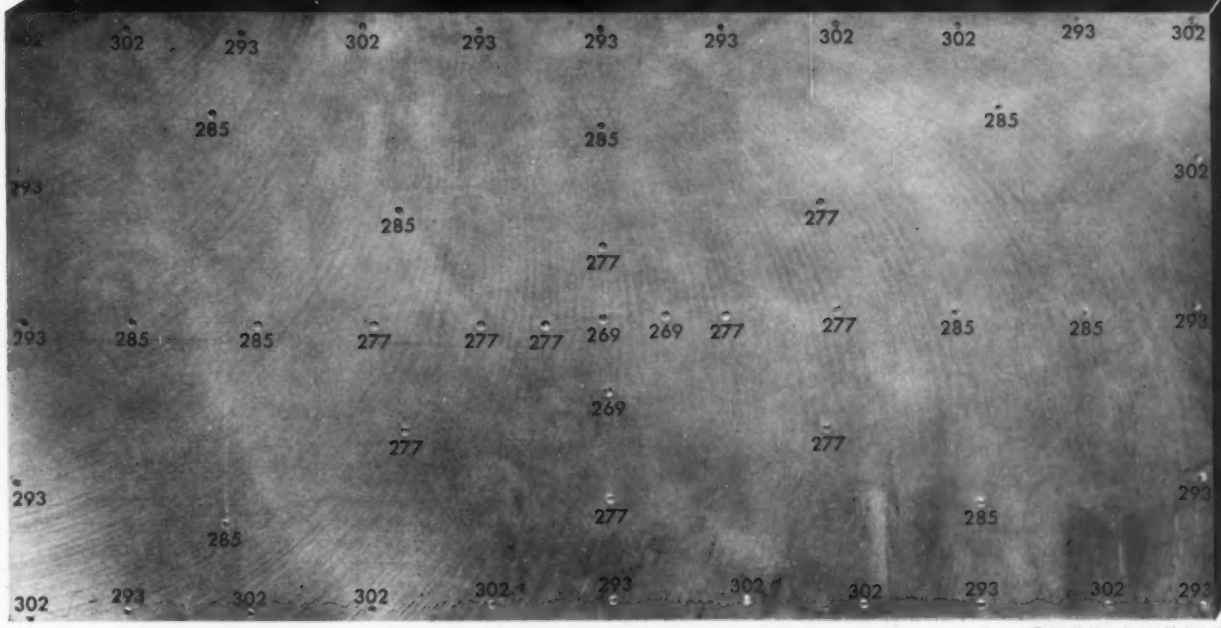
Each Dodge Special Alloy *Steel* Gooseneck is custom made to specifications by the Finished Products Division of Dodge Steel Company. Facilities are available for producing any size gooseneck for any die casting machine. Goosenecks are furnished either rough machined or machined with sleeves. Dodge provides a complete engineering service in the designing and production of steel goosenecks.

Your inquiries are solicited, without obligation, of course. Ask too, about pots and other die casting machine parts including nozzles, spouts, plungers, etc.

DODGE STEEL COMPANY
FINISHED PRODUCTS DIVISION
6501 Tacony Street
Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

Circle No. 25 on Reader Service Card



Brinell Hardness Values

Better finishes for larger, longer-running molds and dies

This photo shows exactly why Crucible CSM 2 helps you build better molds and dies. Prehardened CSM 2 has more uniform hardness throughout the cross section. You can see this yourself in the 20″x10″ specimen above, which was cut through the center of an 8-ft. forged bar. Just look at how constant the Brinell hardness values remain—across the surface...and from surface to center!

NEW **DENSIFYING** PROCESS IMPROVES CENTER SOUNDNESS—To uniform hardness has now been added greater center density. This is accomplished by **DENSIFYING,** a new process developed by Crucible which involves more than the normal consideration of steel analyses and amount of reduction. It includes careful appraisals of ingot size and shape, processing temperature control, and special methods of reduction.

This combination of higher hardenability and more uniform *density* ensures: more uniform polish from top to bottom of the cavity; greater resistance to washing at the cavity's center or bottom; more positive shut-off surface, particularly in internally landed molds and dies; more uniform machining characteristics from top to center of the cavity. It also eliminates the need to heat treat plastic injection molds and zinc die casting dies in sections up to 14″ or 15″ thick.

For further information on higher hardness, **DENSIFIED** CSM 2 and NU-DIE V (H-13) mold and die steels, call your local Crucible steel service center. *Crucible Steel Company of America, Four Gateway Center, P.O. Box 88, Pittsburgh 30, Pennsylvania.*

CRUCIBLE STEEL COMPANY OF AMERICA

Circle No. **22** on Reader Service Card

Eliminate costly machining with

INVESTMENT CASTINGS

Do your small parts have 4, 5 or more machining operations? Do they require materials that are difficult to machine? If so, you should investigate V-R Investment Castings. Machine operations are entirely eliminated, yet intricate details are held to exacting tolerances. You can design for function regardless of shape. Multiple parts are often produced as single units. V-R engineers can develop and cast the proper material to meet the requirements of your application. Send us your specifications today.

COMPLETE DESIGN FREEDOM without compromise for production limitations.

WIDE CHOICE OF ALLOYS to meet your requirements for resistance to heat, corrosion and wear.

CLOSE TOLERANCES MAINTAINED throughout entire production quantity.

EXPERT METALLURGISTS AND ENGINEERS make recommendations on your application.

PARTS SHOWN ACTUAL SIZE

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

864 MARKET ST. WAUKEGAN, ILLINOIS

I-836

Circle No. **63** on Reader Service Card

news of industry & associations *activities of people, companies & groups in the precision metal molding industries*

promotions & changes

American Die Casting Institute, Inc.—*David L. Glass* has been appointed field representative for the Central Regional Group. Mr. Glass previously worked with The Hoover Company for 40 years, retiring from that position last December.

Misco Precision Casting Co.—*Edward L. Champion* has joined the company as a project engineer. *Edwin L. Rogers* has been made head of its ceramic core manufacturing department.

Saramar Aluminum Co.—*Dominic Sarro* has been appointed district sales manager and will sell fabricated products created from aluminum extrusions.

American Society for Metals—*William J. Hilty* has been appointed exposition manager in the communications department. He succeeds *Chester L. Wells*, who is retiring from active service.

Frederic B. Stevens, Inc.—*John W. Manquen* has been promoted to technical director for the Metal Finishing Division.

Alan Wood Steel Co.—*George C. Christy* has been appointed technical sales representative for the mid-west district of the Iron Powder Division.

Crucible Steel Company of America—*John E. Hold* has been appointed assistant to the vice president–operations production.

Foseco, Inc.—*George Fostel, Jr.* has been appointed technical sales representative in the greater New York City area.

Advance Pressure Casting Corp.—*Salescraft Associates* has been appointed a manufacturer's representative in the Cleveland area.

Presentation of first Powder Metallurgy Pioneer Award

In recognition of pioneering work in powder metallurgy, the Metal Powder Industries Federation has set up a Pioneer Award. This will be given annually to the person who, in the opinion of the award committee, has made significant contributions to the science of powder metallurgy and who by virtue of long service in the industry rates as a "pioneer".

GEORGE ROBERTS, retiring president of MPIF, (right) presented Roland Koehring the award.

The first award went to Roland Koehring of Delco Moraine Products Div. of General Motors Corp. Mr. Koehring has been closely associated with powder metallurgy since about 1921 when he made copper powder by filing an ingot and collecting the filings. This was the first successful oilless bearing.

Since 1921, Mr. Koehring has been continually associated with the powder metallurgy industry. He holds about forty patents relating to various phases of it.

Irving B. Hexter Powder Metallurgy Award

Mr. Davis (left) accepts award for V. S. Malakhof (not present) from Mr. Veit.

In memory of the late Irving B. Hexter, founder of the Industrial Publishing Corp. and publisher of PRECISION METAL MOLDING, the Irving B. Hexter Powder Metallurgy Award has been established by PMM.

This award, a cash honorarium, goes to the college student who, in the opinion of the award committee of the MPIF, displays the broadest knowledge of the process and potentials of powder metallurgy.

The first award was made this year at the annual meeting of the Metal Powder Industries Federation in Cleveland. The

continued on page 65

GLASS

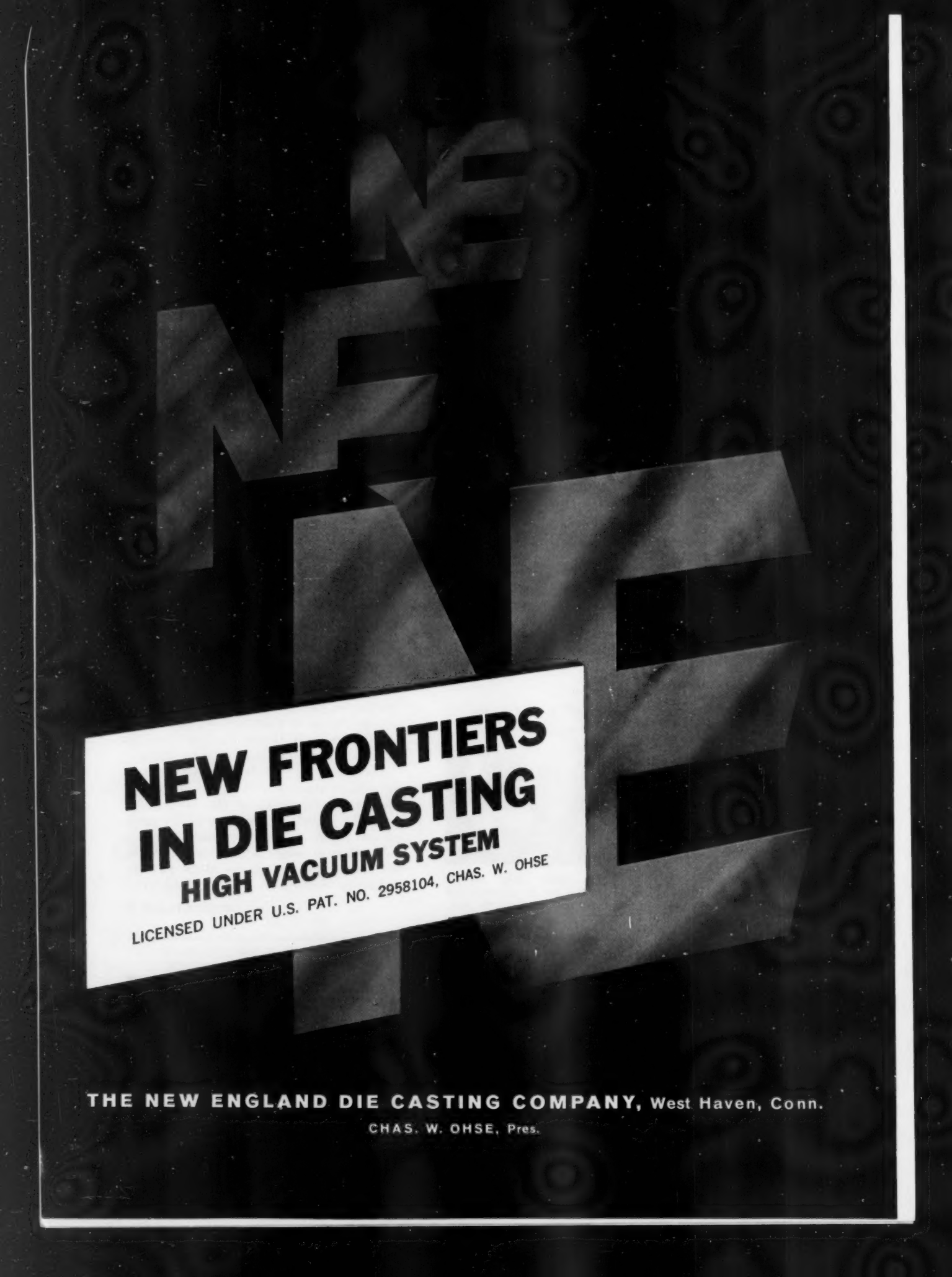
CHAMPION

ROGERS

SARRO

HILTY

MANQUEN


NEW FRONTIERS
IN DIE CASTING
HIGH VACUUM SYSTEM
LICENSED UNDER U.S. PAT. NO. 2958104, CHAS. W. OHSE
THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.
CHAS. W. OHSE, Pres.

Precision Metal Molding
JUNE 1961

MUST YOU MACHINE THAT PART?

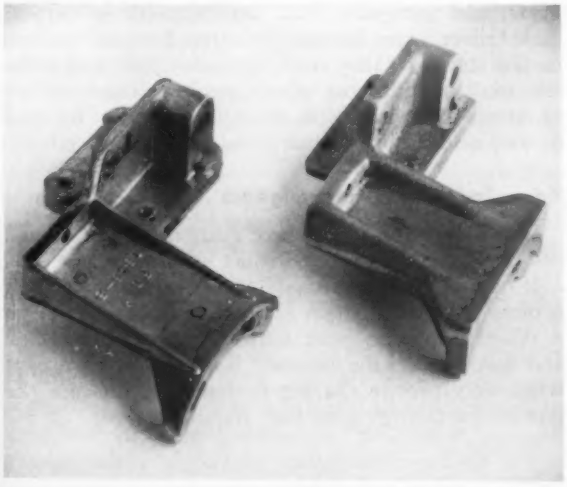
TAKE A GOOD CLOSE LOOK at your sand castings. Are they really saving you money? Don't you get many inaccurate parts that you make-do by machining? Wouldn't you be money ahead if the parts were delivered to your receiving dock ready to use?

Defiance Machine & Tool Co. took just such a look at their aluminum sand castings used on a stenciling machine. Now they are using zinc die castings *and on the first part changed over they saved 75% of the former cost and eliminated 21 machining operations.* That's right, the cost of the finished part dropped from $4.00 to $1.00 and as a bonus the machine tools formerly used to finish sand castings are now free to do other work.

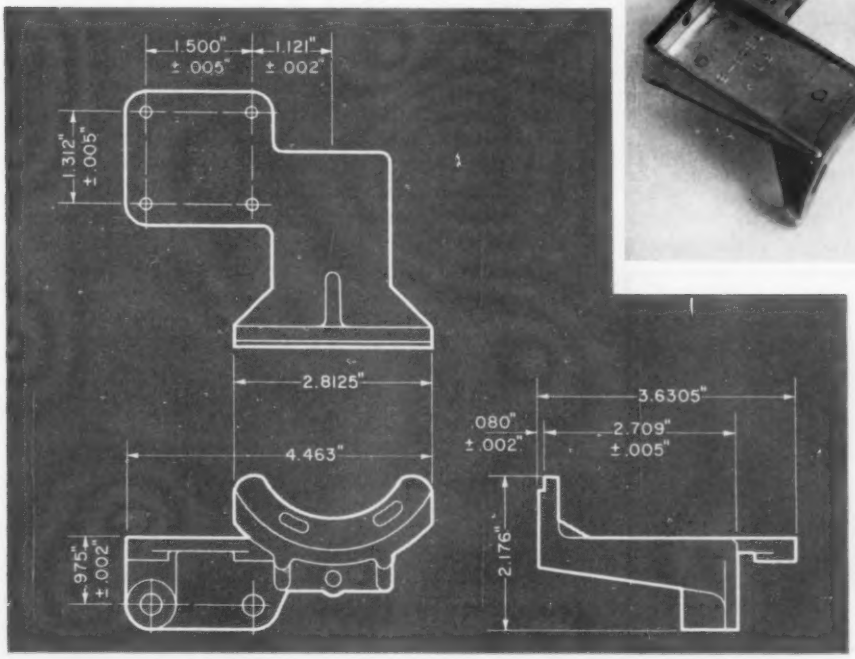
Figure 1 tells the story. The die cast part (left) is received ready for use while the sand cast part (right) is received ready for expensive machining. Close dimensions? Sure. Figure 2 shows how close this part had to be held, but the A. B. Mueller Co., which makes the casting, holds them right on the nose.

But your part is a short run, just a few castings. So what? The die costs on this bracket were justified on the first 100 castings delivered.

So take a look at your sand castings. Defiance did and now they plan to convert eight more sand castings to zinc die castings.



1. $1.00 vs. $4.00, that's the saving story by changing from a sand casting (right) to a zinc die casting (left).



2. CLOSE TOLERANCES can be held by your die caster if they're needed, like these.

DESIGNING FOR POWDER METALLURGY

By **T. L. ROBINSON**, *President, Powdercraft Corp.*

GEARS

(This is the second of a series of articles on the design of parts to be made from metal powders. The first part covered medium and light duty sprockets for use with roller and ladder chain transmissions.)

GEARS MADE BY POWDER METALLURGY methods are widely used for light and medium load transmission systems. These gears replace those made by stamping and shaving from relatively thin sheet stock, hobbed gears, and cut gears. They can be made in copper, nickel silver, brass, bronze, plain iron, low and medium carbon steel, low alloy steel, high alloy steel, and stainless steel. In addition, when required, combinations of metals not available in wrought form may be used as well as combinations of metals and non-metals.

Advantages of sintered gears

Where they can be applied, gears made from metal powders can show many distinct advantages.

If quantities are reasonably great, the cost per unit is often lower than either hobbed or cut gears.

When compared with either hobbed or stamped and shaved gears the accuracy is usually better except when very precise shaving is done. In this case the powder metallurgy gear may require shaving.

This is the second in a series of articles by Mr. T. L. Robinson on the design of parts for powder metallurgy manufacture. Publication dates for the entire series is:

Sprockets	May, 1961
Gears	June, 1961
Gears (concluded)	July, 1961
Cams	August, 1961
Filter and filter materials	September, 1961
Miscellaneous Industrial Parts	October, 1961

Tooth form may be modified, when desired, to get specific shapes, added strength, or other features.

A true involute form can be more closely approached by powder metallurgy methods than any other. Further, the shape will be held better over long production runs.

Combinations such as cluster gears, gears and pinions, gears and clutch members, gears and rackets, and many others can be made as single units instead of two or more separate pieces mechanically joined.

Special properties such as self lubrication are readily incorporated.

Keyways, flats, and non-circular holes to simplify mounting are easy to produce. When desired, keys or splines can be formed in the hub.

Where not to use them

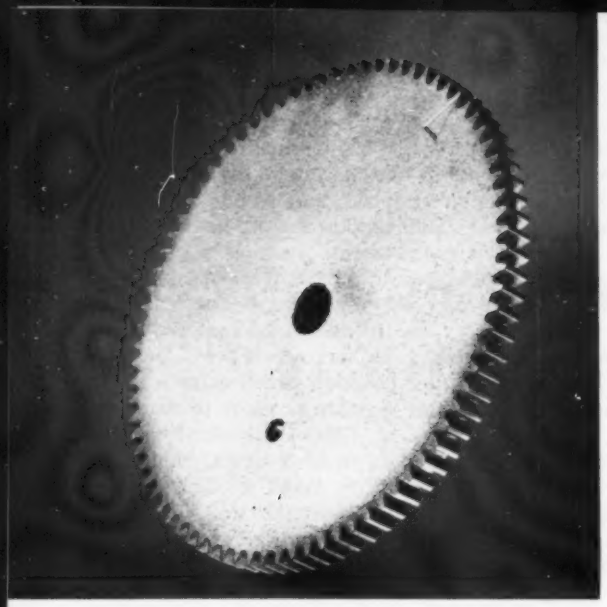
Don't try to use gears made of metal powders for heavy duty transmissions unless you specify copper infiltrated steel which is subsequently hardened. Even with this material, there are many applications where powder metallurgy gears should not be applied. For any heavy duty application consult your vendor before specifying sintered gears.

Generally, don't specify a sintered gear of large diameter. Most fabricators can make gears up to 3" or 4" O.D. In some cases where you have low torque, a segmented gear may be used, but this is rarely economical.

Don't specify a powder metallurgy gear for applications where heavy shock loading occurs. In some applications of this type you can use copper infiltrated gears, but, again, consult your vendor before specifying these parts.

Be careful about specifying hardness. Remember that a hardness measurement (either Rockwell, Brinell, or Vickers) on wrought stock is not the same as a corresponding measurement on sintered stock. You're measuring entirely different characteristics unless the density of the powder metallurgy part is at least 95% of theoretical.

Don't expect the same fatigue life from a porous powder metallurgy gear as you'll get from a cut or hobbed gear.



Where to use them

You can use powder metallurgy gears for almost every application where the load is moderate to light. This includes almost every application where the prime mover is fractional horsepower and many where somewhat higher power transmission is required.

You can use these gears to get special properties such as self lubrication and to avoid assembly operations.

Finally you can specify a sintered gear when a modified tooth shape is required.

Choice of materials

Most powdered metal gears are made in brass, bronze, or iron to which from 3% to 7% copper has been added. These are, however, only a very few of the available metals.

Almost any composition of brass which is available in wrought form can be gotten as a powder. The properties of the gears made from these powders will be very similar to the properties of the wrought stock of the same composition with, always, a somewhat lower ultimate tensile strength and elongation. Depending on the porosity, strength of a powdered metal part may be as low as one-half that of wrought stock and elongation may be zero.

However, much of the loss of strength can be recovered by proper modification of tooth contour.

As with the brasses, most of the wrought bronzes can be gotten as metal powders. The same limitations on strength apply to the bronzes as apply to the brasses. So-called nickel silver is, of course, included with the brasses and bronzes.

An added advantage gotten with powder metallurgy is that non-alloyable metals or alloying agents in excess of the amount which can be cast and rolled may be incorporated. For example, the lead content of a copper base alloy can be increased well above the amount normally found in leaded brasses and bronzes by adding lead powder to the initial powder mix. In a similar manner, tungsten, molybdenum and other metals can be added to get added mass when it is wanted.

The most common ferrous material used is pure iron with a small amount of copper added to control tolerances. This material can be hardened to get parts with a tensile strength of about 60,000 psi. By infiltrating with copper and then hardening, the density can be brought up to almost 100% of theoretical and the strength to 180,000 psi. However, the self lubricating properties are lost by infiltration and dimensional tolerances are not as good as with a plain iron part.

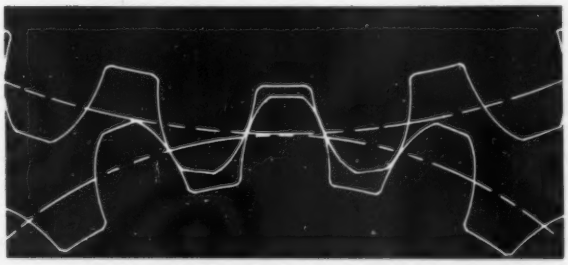
Many of the low alloy steels, some of the high alloy steels, and some compositions of stainless steel are available as metal powders. These materials can all be used to mold gears, but remember that the properties of the parts will not be as good as comparable wrought materials.

The degredation of properties applies to the corrosion resistance of the stainless steels also. The molded gears will have good corrosion resistance, but not as good as the corrosion resistance of cast and rolled alloy.

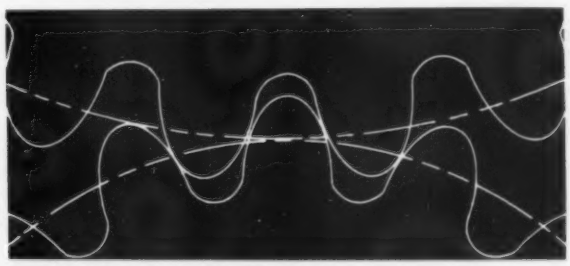
Powdered metal gears can have one distinct advantage over cut or hobbed gears. If the molding tools are properly made and carefully maintained, the surface of the tooth will be smoother than that of a wrought gear. This is due to the absence of tool marks. With the smoother surface, there is better rolling contact on the tooth faces so that the efficiency of power transmission through a gear train is somewhat greater. In some cases this can be very important.

Tooth form

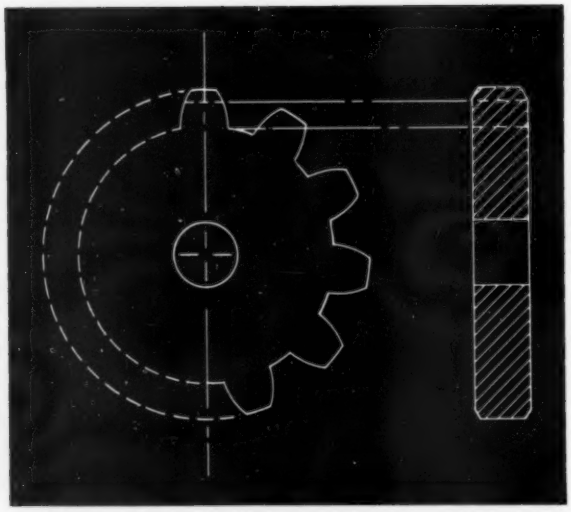
Earlier, mention was made of possible tooth form modification to help overcome the lower strength characteristics of powder metallurgy products.



1. INVOLUTE TOOTH FORM used on all hobbed and cut gears. This has minimum beam strength.



2. MODIFIED INVOLUTE tooth form prefered for powder metallurgy gears. Maximum beam strength.



3. **TIP-OFF OF GEAR TEETH during pressing gives increased density and strength where they're needed.**

One method for doing this is to modify the tooth form at the root by increasing the fillet radius. At the same time the tip of the tooth must be modified to prevent binding. Figure 1 shows a properly generated tooth form which is the commonly accepted involute. In figure 2 this tooth form has been modified by increasing the thickness at the root. The modification has no effect on the efficiency of the gear train since neither the tip or the root are load carrying sections. In effect, we have increased the beam strength of the tooth.

Now most powder metallurgy gears have a load carrying capacity about one-half that of a wrought gear. However, by careful design of the tooth profile as shown in figure 2 the beam strength can be sufficiently increased so that the loss in strength is reduced to not more than 35%.

Another modification of tooth shape which helps powdered metal gears compete with cut or hobbed gears is to tip-off. The modification is shown in figure 3. Here a slight bevel, if you will, has been formed at the tip of each tooth. This modification increased the density of the tooth somewhat and hence increases the strength. As before, there is no loss in power transmission by this modification, but there is an appreciable increase in load carrying ability.

The two modifications are only a few of those which a skilled powder metallurgist can make to allow sintered gears to compete with wrought gears. Remember too, almost all gearing in the light and medium power transmission field is greatly over designed. The inherent strength of the wrought material is not needed for the amount of power involved and if true load conditions are determined it will be rare to find a case where more than one-half the strength of the metal used is needed. This applies to wrought gears only, of course.

In the design of powdered metal gearing, therefore, it is always best to let your vendor design the entire gear train. If he is skilled in gear manufacture he can design a train which will function properly, transmit all the power required, achieve any desired change in speed, and can be produced at minimum cost. The vendor should be furnished with the over-all requirements such as number of teeth, center distances and allowable backlash. Given this information the gear train can be designed so that the strength of the teeth can be materially increased. Theoretically a 50% increase is possible.

It has become rather common practice for a prospective user of powder metallurgy gears to machine trial gears from slugs of sintered material of the composition to be used in molded gears. Never do this if it is at all possible to avoid it. Gears made in this manner will have from 20% to 50% lower strength compared with molded gears. This decrease in strength comes from loss of the high density skin, inability to cut the most desirable tooth form, variable density of the slug from which the gear is cut, and often poor machining due to lack of knowledge on how to machine parts made from metal powders. While it is possible to tip-off the cut teeth to get the same shape as a molded gear tooth, the effect is entirely different.

Dimensional accuracy

In general, powder metallurgy gears can be made to as close dimensional tolerances as cut gears and to closer tolerances than hobbed gears. Usually, these gears are made to meet American Gear Manufacturers' Association, class 3 accuracy. Some smaller gears have been produced to class 4, but larger gears may fall between class 2 and class 3.

Where extreme accuracy is required and a cut and shaved gear is required, a powder metallurgy gear can be the starting point as well as the cut gear. The final accuracy will be the same.

Reproducibility of close tolerances is generally greater with gears made from metal powders than with either cut or hobbed gears. With properly designed and maintained tools large numbers of gears can be made to standard commercial tolerances without any tool dressing or replacement. It is very possible to make more than 50,000 gears to standards set by the American Gear Manufacturers' Association before any off tolerances parts are produced in quantity.

Self damping qualities

Gears made from wrought steel tend to ring when operating. In many cases this can be annoying and may sometimes be intolerable. For example, in automobile oil pumps wrought steel gears tend to ring and this noise is transmitted through the body of the car. In these cases it is not economically possible to use precision ground gears to eliminate the noise. The solution has been found in powdered metal gears. The self damping nature of these parts completely eliminates all ringing.

(Note: *The second part of this article on sintered gears will be published in* PRECISION METAL MOLDING *in July.*)

COPPER-BASE EXTRUSIONS

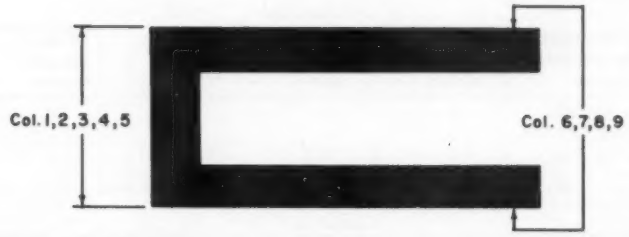
Extrusions in copper-base alloys offer the design and production engineers a high degree of design flexibility, and a means of cutting production costs. Eight points as to why the design engineer should specify extruded sections were given in Part I (PMM May 1961, pg. 35). The last four points are concluded in this issue.

9. Dimensional tolerances

Commercial tolerances for copper and copper-base alloy shapes have been set up by the extruders. These tolerances cover metal dimensions, space dimensions, straightness, twist, angularity, curved surfaces, flat surfaces, cut ends, corner and fillet radii, surface roughness, and length.

When either broader tolerances may be allowed or closer tolerances are required the extruder should be advised. In all other cases shapes will be made to commercial tolerances. The standard commercial tolerances are given in Tables VIII, IX, and X.

TABLE VIII—COMMERCIAL CROSS SECTIONAL DIMENSION TOLERANCES



Specified Dimension in Inches	METAL DIMENSIONS — 75 Per Cent or More of the Specified Dimension is Metal					SPACE DIMENSIONS—PLAIN EXTRUDED — 25 Per Cent or More of the Specified Dimension is Space			
	PLAIN EXTRUDED			DRAWN OR ANNEALED & DRAWN		At Points ¼-⅝" Not Inc. From Base	At Points ⅝-1¼" Not Inc. From Base	At Points 1¼-2½" Not Inc. From Base	At Points 2½" or Over From Base
	Muntz Metal & Leaded Brasses 1	Manganese Bronze 2	Naval Brass Ni Silver 3	Naval Brass 4	Copper & Alloys 5	6	7	8	9
Up to .125	.005	.0075	.010	.005	.003	.010	.012	.014	.016
.126 to .250	.005	.0075	.010	.005	.003	.012	.014	.016	.020
.251 to .500	.005	.0075	.015	.005	.003	.014	.016	.018	.022
.501 to .750	.0075	.010	.020	.0075	.005	.016	.018	.020	.026
.751 to 1.000	.0075	.010	.020	.0075	.005	.018	.020	.022	.030
1.001 to 1.500	.010	.015	.025	.010	.0075	.020	.022	.026	.034
1.501 to 2.000	.010	.015	.025	.010	.0075	.024	.028	.034	.050
2.001 to 3.000	.015	.020	.030	.015	.010	.032	.036	.048	.064
3.001 to 4.000	.020	.030	.035	.020	.015	.032	.036	.048	.064
4.001 to 5.000	.030	.040	.045	.030	.020	.042	.050	.064	.088
5.001 & Over	.035	.050	.060	.035	.030	.042	.050	.064	.088

NOTES:
1—Tolerances are plus and minus; if tolerances all plus or all minus are desired, double the values given.
2—Tolerance on thickness of Architectural Shapes and Thresholds plus and minus .010 inch.
3—For tolerance on space dimensions on drawn shapes take half the plain extruded space tolerance.
4—In some cases tolerances closer than commercial can be held (SUBJECT TO MILL APPROVAL).
5—For tolerances applicable to plain extruded angles, half rounds and half ovals, multiply above listed Plain Extruded Tolerances by 1.5.

TABLE IX—PRODUCTION TOLERANCES

STRAIGHTNESS (all alloys)

Tolerances in table below represent maximum bow or depth of arc.

Circumscribing Circle Diameter inches	Tolerance—inch	
	Allowable deviation from straight	
	In each foot of length	In total length of piece
up to ¾"	.025"	Length in feet times .025"
over ¾"	.0125"	Length in feet times .0125"

Circumscribing circle diameter is the diameter of the smallest circle that will completely enclose the shape.

ANGULARITY (all alloys)

Allowable deviation from specified angle	Temper
1°	Plain Extruded
½°	Extruded and Drawn

CURVED SURFACES (all alloys)

Allowable deviation per inch of chord length	Temper
.005"	Plain Extruded
.0025"	Extruded and Drawn

Tolerance for one inch is the minimum in all cases.

FLAT SURFACES (all alloys)

Allowable deviation from flat per inch of width	Temper
.004	Plain Extruded
.002	Extruded and Drawn

Tolerance for one inch is the minimum in all cases.

CUT ENDS (all alloys)

Maximum allowable deviation from square is 1°.

CORNER AND FILLET RADII (all alloys)

Specified radius inches	Tolerance—Inch Allowable deviation from specified radius
Sharp Corners	010
Under .188	1/64
.188 and Over	10%

TWIST (all alloys)

Maximum allowable deviation is 1° per foot of length.

NOTE:—

All tolerances under commercial values given above—consult mill.
These tolerance schedules are applicable to commercial material in the absence of other specifications by the purchaser.

TABLE X—LENGTH TOLERANCES

LENGTH (specific or multiple lengths)

All tolerances in table below are plus. If tolerances plus and minus are desired, halve the values given. If tolerances all minus are desired use same values.

Alloy	Weight-pounds per foot	Circumscribing Circle Diameter inches	Manual Cut: Min. Length inches	Manual Cut: Mill Length feet	Manual Cut: Tolerance inches	Automatic Cut: Min. Length inches	Automatic Cut: Max. Length inches	Tolerances inches
1*	Up to 15	Up to 1½ Incl.	6	12	⅛	¼	24	Tolerances same as plain extruded cross sectional tolerances with Min. .005 and Max. .015
		Over 1½ to 2 Incl.	6	12	⅛	¼	24	
		Over 2 to 3 Incl.	6	12	3/16	—	—	
		Over 3	6	12	¼	—	—	
	Over 15	2¼ to 3 Incl.	6	Consult Mill	¼	¼	24	
		Over 3	6	Consult Mill	¼	—	—	
2**	Up to 20	Up to 1½ Incl.	6	12	⅛	¼	24	
		Over 1½ to 2 Incl.	6	12	⅛	¼	24	
		Over 2 to 3 Incl.	6	12	3/16	—	—	
		Over 3	6	12	¼	—	—	
	Over 20	2⅝ to 3 Incl.	6	Consult Mill	¼	¼	24	
		Over 3	6	Consult Mill	¼	—	—	

NOTE: For tolerances desired less than commercial tolerances listed, consult mill.

*1. This group includes Electrolytic copper, OFHC copper, silver bearing copper, and free cutting copper.
**2. This group includes all other extrudable copper base materials.

LENGTH (mill lengths)

Alloy	Weight in pounds per foot	Schedule of Lengths in % of lot weight
100, 103, 104, 108,	Up to 15 Incl.	Min. 40% 12 Ft. Max. 30% 6-12 Ft. Max. 30% 2-6 Ft.
203	Over 15	Consult mill
180, 240, 247, 250,	Over ½ to 1 Incl.	Min. 60% 12 Ft. Max. 40% 8-12 Ft.
277, 280, 283, 285,	Over 1 to 3 Incl.	Min. 60% 12 Ft. Max. 40% 6-12 Ft.
380, 386, 387, 389,	Over 3 to 20 Incl.	Min. 60% 12 Ft. Max. 40% 3-12 Ft.
454, 469, 565	Over 20	Consult mill

NOTE: For tolerances desired less than commercial tolerances listed, consult mill.

10. *Choice of alloys*

Not all copper and copper-base alloys can be extruded successfully. Table XI lists those most commonly employed with the physical and mechanical properties of the different materials as extruded.

The choice of a specific metal will, of course, depend on a variety of factors. As a general guide, Table XII gives some general characteristics and the recommended alloy for each. In addition other characteristics of the various metals are given to aid the designer in selecting the best material for each specific purpose.

11. *Good mechanical properties*

The general mechanical properties of extruded shapes will compare favorably with those for rolled

TABLE XI—COMPARATIVE MECHANICAL AND PHYSICAL PROPERTIES OF EXTRUDABLE COPPER-BASE ALLOYS

Alloy Name	Copper	Free-Cutting Copper	Leaded Commercial Bronze	Medium Leaded Brass	Special Low-Leaded Brass	Riveting and Turning Rod	Free-Cutting Brass	Forging Brass	Muntz Metal	Leaded Naval Brass	Naval Brass	Free-Cutting Naval Brass	Manganese Bronze	Architectural Bronze Heavy-Leaded	Architectural Bronze	Arsenical Bronze	13% Nickel Silver	10% Nickel Silver
Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Nominal Composition, percent: Copper	99.90 min.	99.4	89	64.5	63	62	61.5	60.0	60.0	60	60	60	58.5	57	56.5	56.5	43	46.25
Zinc	—	—	9.25	35	36.25	36.25	35.5	38.0	40.0	38.5	39.25	37.5	39.2	40	41.25	39	44	43.75
Lead	—	—	1.75	0.5	0.75	1.75	3.0	2.0	—	0.75	—	1.75	—	3	2.25	0.75	—	—
Other		To 0.6, P 0.007 max.								Sn 0.75	Sn 0.75	Sn 0.75	Fe 1.0, Sn 1.0, Mn 0.3			Ni 2.0, As 0.6 Mn 0.2, Fe 1.0	Ni 13.0	Ni 10.0
General Properties	High electrical conductivity, high thermal conductivity, excellent working ability.	Similar to copper but with free-cutting properties.	Good bending properties for simple shapes such as drawer handles.	Good bending and forming properties but restricted to simple shapes—good machinability.	Same as medium-leaded brass but with slightly better machinability.	Best compromise between machining & moderate cold-forming properties.	Excellent machinability combined with good mechanical and corrosion resistance properties.	Extremely plastic hot—combining good corrosion resistance with excellent mechanical properties.	Inexpensive combination of good strength and moderate ductility.	Resistant to salt water corrosion with added machinability.	Resistant to salt water corrosion, satisfactory for moderate cold-working operations.	Similar to free-cutting brass but with increased strength and corrosion resistance.	High strength combined with excellent wear resistance.	Excellent free machining and forging properties.	Excellent forging and machining properties.	Excellent forging properties.	Silvery white color.	Silvery white color.
Working Properties: Cold Working	Excellent	Good	Good	Good	Fair	Fair	Poor	Fair	Fair	Poor	Fair	Poor	Poor	Very Poor	Very Poor	Poor	Poor	Fair
Hot Working	Excellent	Good	Poor	Poor	Fair	Fair	Good	Excellent	Excellent	Good	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Good
Machining	Poor	Excellent	Good	Good	Good	Good	Excellent	Good	Good	Good	Good	Excellent	Good	Excellent	Good	Good	Good	Good
Welding	Deoxidized Type Preferred	Not recommended	*	*	*	*	*	*	Gas, carbon arc, metal arc	*	Gas, carbon arc, metal arc	*	Gas, carbon arc, metal arc	Poor	Poor	*	Fair	Fair
Soldering	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Good	Excellent	Good	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Polishing	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Good	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Density, lb/cu in.	0.322	0.323	0.319	0.306	0.306	0.306	0.307	0.305	0.303	0.305	0.304	0.305	0.302	0.306	0.305	0.302	0.315	0.315
Young's Modulus of Elasticity, psi (000,000 omitted)	17	17	17	15	15	15	14	15	15	15	15	15	15	14	14	16	17	
Melting Point, deg F	1,981	1,981	1,900	1,700	1,660	1,650	1,650	1,640	1,660	1,635	1,650	1,650	1,630	1,630	1,623	1,630	—	—
Avg. Coefficient of Thermal Expansion per deg F (68 to 570 F)	0.0000098	0.0000098	0.0000112	0.0000113	0.0000114	0.0000114	0.0000114	0.0000115	0.0000116	0.0000118	0.0000118	0.0000118	0.0000118	0.0000116	0.0000116	0.000011 8	—	—
Electrical Conductivity % IACS at 68 F	101 (annealed)	90 min.	42 (annealed)	26	27	28	26	27	28	26	26	26	24	28	28	—	—	—
Thermal Conductivity Btu/sq ft ft/hr F at 68 F	226	205	104	67	69	73	67	69	71	68	67	67	61	71	71	—	—	—
Tensile Strength, psi	32,000	32,000	37,000	48,000	46,000	50,000	49,000	52,000	54,000	57,000	57,000	57,000	65,000	60,000	60,000	65,000	85,000	81,000
Elongation, % in 2 in.	55	40	45	60	55	58	53	45	50	42	47	40	33	30	30	40	20	22
Yield Strength, 0.5% ext., psi	10,000	10,000	12,000	12,000	14,000	15,000	18,000	20,000	21,000	19,000	25,000	25,000	30,000	20,000	20,000	22,000	50,000	45,000
Rockwell Hardness	40 F	40 F	55 F	56 F	69 F	67 F	68 F	78 F	80 F	82 F	55 B	55 B	65 B	65 B	65 B	85 B	83 B	75 B
Forging Temp., F	1,400-1,600						1,300-1,450	1,200-1,500	1,150-1 450	1,200-1,400	1,200-1,450	1,200-1,400	1,150-1,450	1,150-1,350	1,150-1,350	1,200-1,450	1,150-1,550	1,150-1,550
ASTM Specifications	B124		B140					B124	B124		B21, B124	B21	B124, B138					

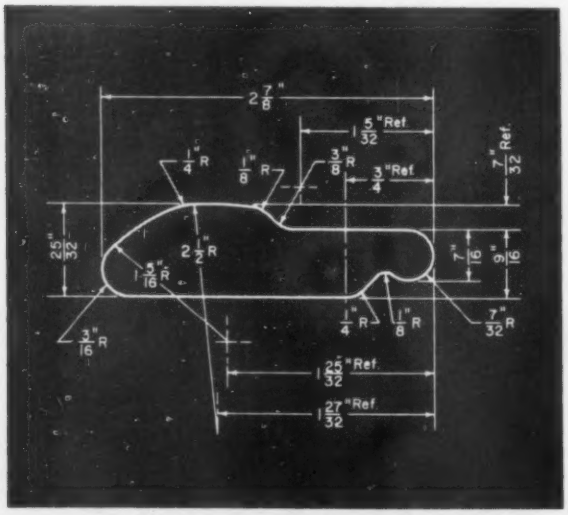
*Non-leaded alloys preferred for welding.

TABLE XII—HOW TO SELECT EXTRUDABLE COPPER-BASE ALLOYS

WHEN YOU WANT . . .	CHOOSE	
Highest electrical and thermal conductivity	Copper (No. 1)	Machinability poor. Excellent bending, peening. Average minimum thickness about 0.125 in.
Over 90% conductivity plus machinability	Free-cutting Copper (No. 2)	Machinability very good. Bending good. Moderate peening, swaging. Average minimum thickness about 0.125 in.
Good bending and flaring	Leaded Brass (Nos. 4, 5, 6)	Machinability good. Sections must be relatively simple. Desirable minimum thickness about 0.187 in.
Good punching	Muntz Metal (No. 9)	Moderate bends. Excellent brazing. Machinability good. Fairly simple sections and minimum thickness about 0.187 in. desirable.
Excellent machinability	Free-cutting Brass (No. 7)	Good strength. Slight bending or peening if dead soft. No restriction of sections but minimum average thickness about 0.125 in. desirable.
	Architectural Bronze (Nos. 14, 15)	Good strength. No bending, peening. No restrictions on sections. Minimum thickness about 0.062 in.
Hot forging	Forging Brass (No. 8)	Strong and hard. Good machinability. Large radius bending permissible. Any sections obtainable with minimum thickness about 0.125 in.
High strength	Manganese Bronze (No. 13)	Good wear resistance. Fair machinability. Simple sections with minimum thickness about 0.187 in.
	Arsenical Bronze (No. 16)	Good wear resistance. Good bearing properties, particularly at low speeds. Excellent machinability. Simple sections with minimum thickness about 0.187 in.
Corrosion resistance	Naval Brass (No. 11)	Fair machinability. Little to moderate bending. Good strength. All sections possible with minimum thickness about 0.125 in.
	Leaded Naval Brass (Nos. 10, 12)	Good machinability. Otherwise same as Naval Brass.
White color	Nickel Silver (No. 17)	Very hard and strong. Fair machinability. Some bending. All types of sections to about 0.187 in. minimum.

stock and forgings. This assumes that no machining has been done on any of the forms. When bar stock must be machined or when forgings must be machined, an extruded shape will generally have better mechanical properties.

Because of the extensive working of the metal during extrusion, shapes will have a fine grain structure and will be completely free of defects commonly found in cast metals.



6. PROPER DIMENSIONING is required to get the part you want from your extruder.

12. *Short runs*

Most mills can supply small amounts, even as little as a single billet, with no penalty other than the set-up charge. At the time a mill is running the right metal and the right diameter billet, the charge to change dies is quite small. Short runs can, therefore, be handled quickly and easily. For those companies who may not want to carry a large metal inventory, it can often pay to order in small amounts and pay the added set-up charge. As we have noted, however, there may be some delay due to mill scheduling.

While the foregoing twelve points are certainly not all inclusive they will give the designer or production man a fairly good picture of what copper and copper alloy extrusions can do.

But to get the best shape at the lowest possible cost, it is absolutely essential that the mill be furnished with drawings which are both accurate and properly dimensioned, and also with sufficient information so that an intelligent quotation can be made. Above all, it is essential that enough information is furnished so that all mills bid on exactly the same piece.

A properly dimensioned drawing is shown in figure 6. With this drawing there will be no question as to shape or dimensions.

NOTE — *Material for this report was furnished by Revere Copper and Brass, Inc.*

A non-solvent process for production of . . .

ETHYL SILICATE BINDER FOR INVESTMENT MOLDS

By **G. N. ZIEGLER** and **R. V. LAMAIRE**

ETHYL SILICATE BINDER for investments may be hydrolyzed without the use of a solvent. The characteristics of this type binder are similar to those of an alcohol-base binder.

Non-solvent-hydrolyzed solutions lower costs by eliminating the solvent. Fire hazard is also reduced.

The non-solvent process demands more careful production control to insure satisfactory gelation.

A mixture of ethyl silicate and water, with a small amount of hydrochloric acid, will hydrolyze readily when agitated vigorously. Agitation is needed because the two liquids are immiscible.

The reaction of an ethyl radical with an hydroxyl ion to produce ethyl alcohol is similar to the reaction in the "solvent-hydrolysis" process.

In the non-solvent process, two factors must be considered:

- A large amount of heat is given off during the hydrolysis.
- The rate of the reaction increases with increased temperature.

The hydrolysis will proceed slowly until the temperature reaches 90°-100°F. Then the reaction speeds up and temperature will rise rapidly. The temperature may increase enough to boil off alcohol. Also, precipitation of silica or premature gelation may occur.

Cooling coils in the mixing tank will control the temperature and retard the reaction. After hydrolysis, the solution is cooled to room temperature and diluted with water to make a binder of the desired silica content. The shelf life and time of gelation are determined by adjusting the temperature and pH. The practices for processing molds are similar to those used with solvent-hydrolyzed binders.

Production operating procedures

As an example of typical production operations, a binder formulation is shown in Table I.

A silica content of 10% was chosen since this has proven satisfactory for a wide variety of castings. Other silica contents can be produced by varying the final water addition. Condensed ethyl silicate (nominal 28% silica grade) is used as the silica source. There has been some success using the 40% silica grade.

The condensed ethyl silicate is weighed-out and put into a stainless steel mixing drum fitted with cooling coils. The acid-water solution is added and the mixture is vigorously agitated. The temperature of the reacting mixture is limited to 135°F. Figure 1 is a time-temperature curve for a typical hydrolysis.

Production experience has indicated that a minimum hydrolysis temperature of 125°-130°F. should

TABLE I

Approximately 50 Gal. Batch, Nominal 10%* SiO_2 Content

Condensed Ethyl Silicate	144.5 Lbs.	
2.5 Normal HCl[1]	500 ml.	Mix together and
Water (of known pH)	3.8 gal.	add to C.E.S.

Water after complete hydrolysis 27.4 gal. (of known pH)

*By varying the amount of water added the silica content of the binder may be varied up or down.

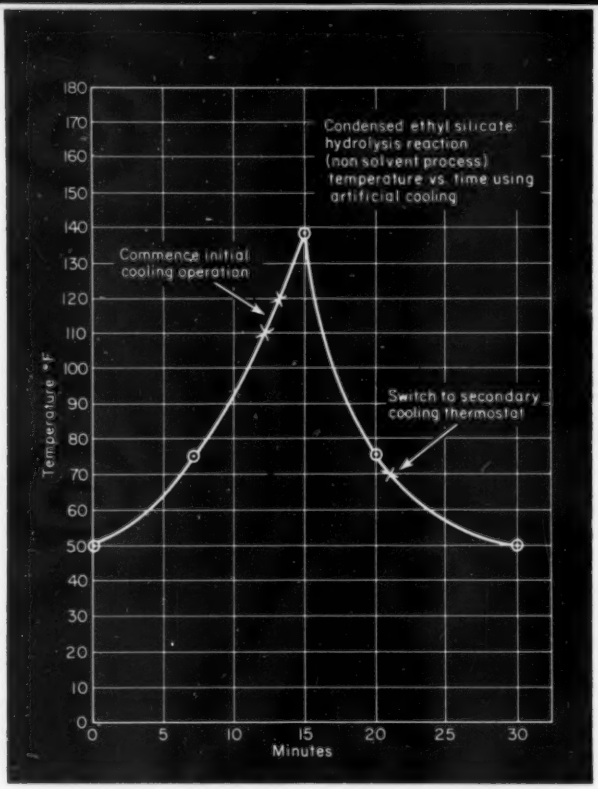
Accelerator Addition for 50 Gal. Batch

Sodium Succinate 190-235 gms.

Mix the accelerator with water in the ratio of 7.5 gms. per 100 ml. of water.

The amount of the accelerator addition is adjusted to produce a binder pH of approximately 4.4-4.8.

[1]If so desired, approximately 110 ml. of 22°Be HCl may be added in place of the 500 ml. of 2.5 normal HCl. This will produce about the same acid concentration. However, the error in measuring the acid from batch to batch will tend to be greater.



1. TEMPERATURE VS. TIME with artificial cooling for the condensed ethyl silicate hydrolysis reaction.

be held to insure complete miscibility and to avoid partial silica precipitation or premature gelation.

When the temperature of the hydrolyzed mixture has fallen to about room temperature the secondary water addition is made. Some heat is liberated simply by the mixing of water and alcohol. However, if the temperature rise (without artificial cooling) is more than two or three degrees Fahrenheit, it may indicate that the original hydrolysis was incomplete.

The cooling of the binder is continued to 45°-55°F. This retards binder gelation for a short time (½ –1 hour) to allow additional working time.

A water solution of sodium succinate is used as the accelerator and is mixed into the binder (see Table I) just prior to draining the binder from the mixing tank. The binder is mixed with investment and invested in molds no longer than ½ –1½ hours after the accelerator addition.

Most of the dipcoats for use with "solvent-hydrolyzed" ethyl-silicate investment binder have been found compatible with back-up investments utilizing a non-solvent binder. A majority of the work was done utilizing sodium silicate or Nalcoag base dipcoats and this binder has not exhibited the solvent action often shown by water-based binders. Almost all of the common dipcoat refractories are compatible, silica flours are generally used.

The investment dry materials consist of fire clay grog, reclaimed grog, silica sand and silica flour. These are combined in the proportions shown in Table II. Normally 500 lb batches are weighed up and put in steel drums for storage and transport. Dry and wet mixing are done consecutively in a 600 lb. concrete mixer. Several minutes are allowed for dry mixing before the liquid binder is added. An additional supply of pre-mixed dry investment is provided to adjust the consistency of the investment mix if necessary.

Molds are invested directly from the wet mixer and transferred to tables for consolidation. Using the investment mix shown in Table II, 30-45 minutes at room temperature are required to pack a 12-inch depth of slurry to a height of 8-9 inches. The molds can be removed from the packing tables as soon as they are packed. Either before or after gelation the mold heads are cut off. Since it is usual to provide for slower gelation of the non-solvent binder, as compared to the solvent hydrolyzed binder, the bottom plates must be heated to loosen the wax sealer rather than knocking the plates loose. This method leaves a protective layer of wax adhering to the mold face.

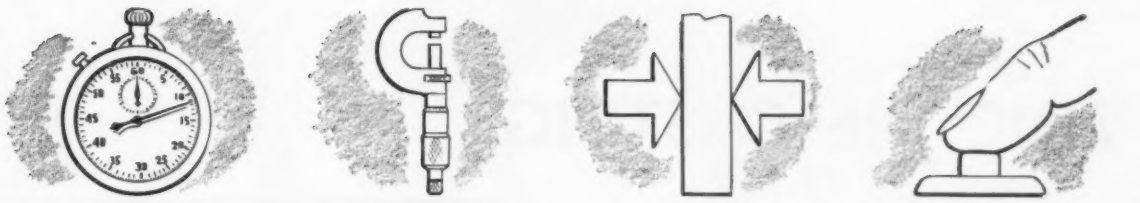
Molds are usually stored for 6-8 hours after gelation before dewaxing. Completeness of the gelation is checked by stripping a piece of wax from the mold face and examining the exposed investment for clean parting of the wax and investment. Since the binder contains about 30% alcohol, mold drying practices are somewhat similar to those employed when "solvent-hydrolyzed" binders are used.

The completed investment molds are dewaxed at 200°-225°F. in gas-fired re-circulating air ovens. After dewaxing the molds are transferred to final burnout at temperatures of 1200-1900°F.

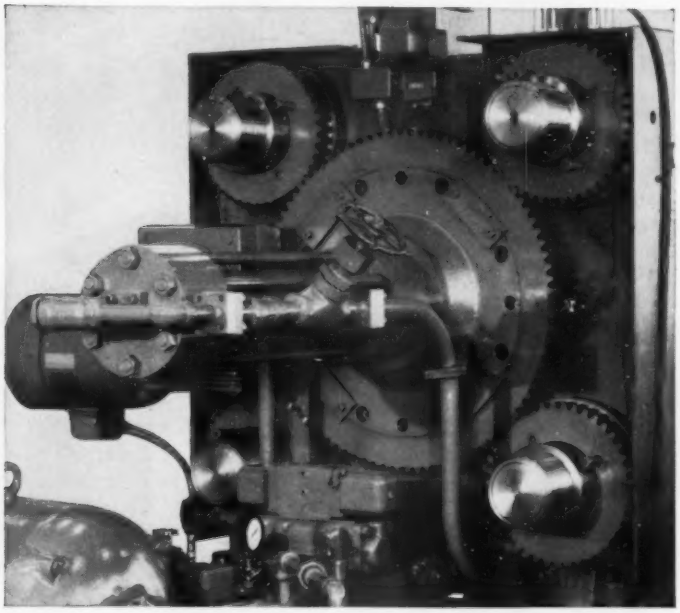
A discussion of the control procedures, formulation, and equipment used with ethyl silicate binders will appear next month.

TABLE II—INVESTMENT BLEND

MATERIAL	TYPICAL ANALYSIS: Cumulative % Retained on Screen No:										
	20	28	35	48	65	80	100	150	200	270	Pan
Virgin "20 x 65" Grog.	2.6	41.0	68.0	89.6	99.0	99.5	99.7				99.9
Reclaim "20 x 65" Grog.	2.0	33.0	65.0	94.6	99.0	99.5	99.7				99.9
Silica Sand				0.5	12.0	37.0	68.0	84.0	96.0		99.8
90 Mesh Silica Flour					2.2	4.6	7.2	19.0	21.8	31.8	43.8
Dry Blended Investment	1.3	14.4	26.4		48.4		59.3		68.4	73.7	99.7



PUSH-BUTTON DIE HEIGHT ADJUSTMENT AND TONNAGE CONTROL... *a valuable operating advantage of Greenlee-B&T Die Casting Machines*



At the touch of a button you can now get die height adjustment for set-up and tonnage control. The Greenlee-B & T system uses a gear-head electric motor to drive a large bull gear which in turn drives a pinion gear on each tie bar nut.

This system maintains . . .

(1) inherent rigidity of our clamp by equal loading of each tie bar and set of four corner links.

(2) large bumper bar pattern, both vertical and horizontal, because there is no central screw interference.

(3) large range of die height adjustment normally available with tie bar nut machines without sacrificing individual nut adjustment.

(4) accessibility of hydraulic ejector mechanism.

Greenlee-B & T motorized die height adjustment permits the flexibility of other designs. In addition it provides easier control and adjustment without sacrificing rigidity. Write for complete information.

PRODUCTION MACHINERY
GREENLEE
B&T

"Don't miss the boat . . . get a B&T quote"

Other Greenlee-B&T Design Advantages

- Four-Corner Link Lock-Up
- Two Stage Variable-Speed Shot Control
- Automatic Press Lubrication and Die Lubrication
- Machine Automation
- Improved Hydraulic Circuit and Welded Flange Connections

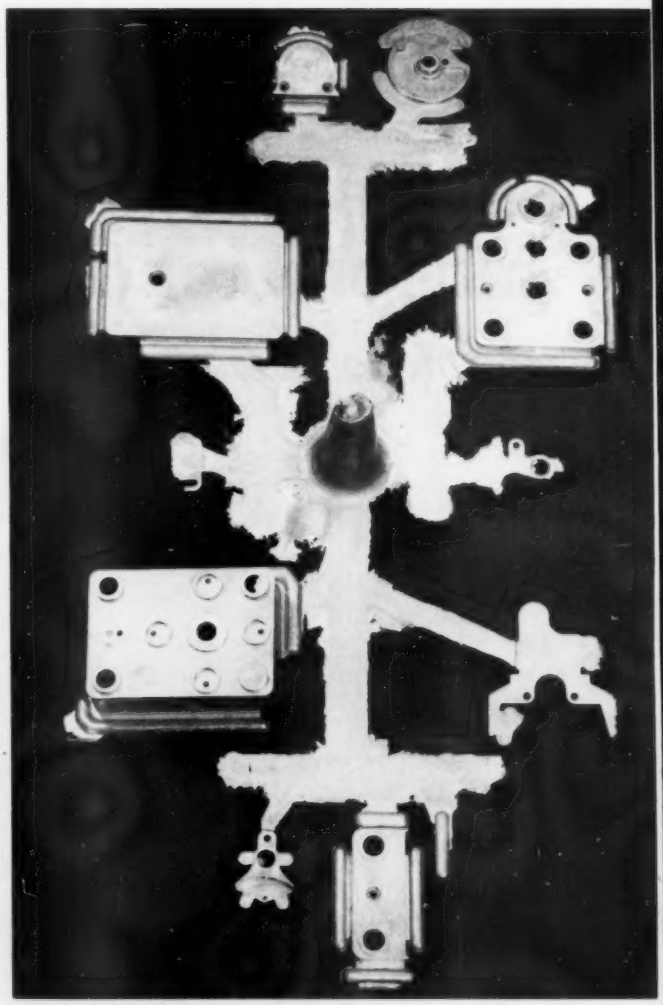
B&T MACHINERY COMPANY
A DIVISION OF GREENLEE BROS. & CO.

217 W. EIGHTH ST.
HOLLAND, MICHIGAN
phone EXport 2-2341

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC TOOLS FOR CRAFTSMEN

Circle No. 13 on Reader Service Card

ZINC DIE CASTINGS FOIL YEGGS



EACH GATE OF CASTINGS furnishes a complete set for each vault lock. Unit dies permit part changes, when necessary.

YEGGS WOULD BE CONFRONTED with nine zinc die castings and one brass extrusion if they tried to crack a Sargent & Greenleaf, Inc. 6500 series Universal Burglar-Proof Vault Lock. The lock is called "universal" because you can interchange and reposition the die cast parts to make ten lock variations.

The shaft plate, for example, which houses the outside gear, can be positioned on the top, the end, or the bottom. The lock can be right or left hand mounted. Five die cast bolt styles are interchangeable in the same die cast case. The lock combinations can be either key changed or hand changed. In short, die castings make it easier to make the lock. But more important, the vault maker has to stock only one lock instead of ten.

The universal lock series replaced a lock made from sand castings. The sand cast lock was similar in size and design, but did not have flexibility. It was hard to design sand cast parts that could be interchanged. Then too, sand castings had these disadvantages: 1. A great deal of machining was required. There was more metal to remove, more milling, drilling and tapping than with die casting. 2. Poor appearance. The rough surface made it difficult to provide a satisfactory surface appearance. 3. High reject rate. The die castings, besides their versatility, have these advantages:

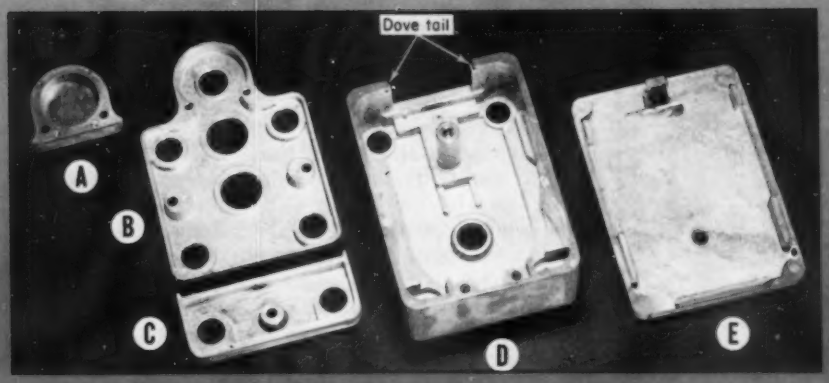
1. **Appearance**—The smooth surface lends itself to the application of a nickel-satin finish.
2. **Little Machining**—Most of the castings are used as-cast, trimmed and finished.
3. **The unit die** makes it possible to die cast all nine of the basic die castings at once.
4. **Cast-in inserts**—The ability to cast in inserts, such as the steel shaft in the key, and the brass wheel post in the bridge, is a cost saving feature of die casting. It saves special assembly operations.
5. **Cost**—The switch to die casting cut manufacturing costs in half.

Now let us examine the die castings used, their function, and the machining required for each.

Case (figure 1d). Houses all the components. After trimming it is ready for finishing. The dovetail (figure 1d) is cast in.

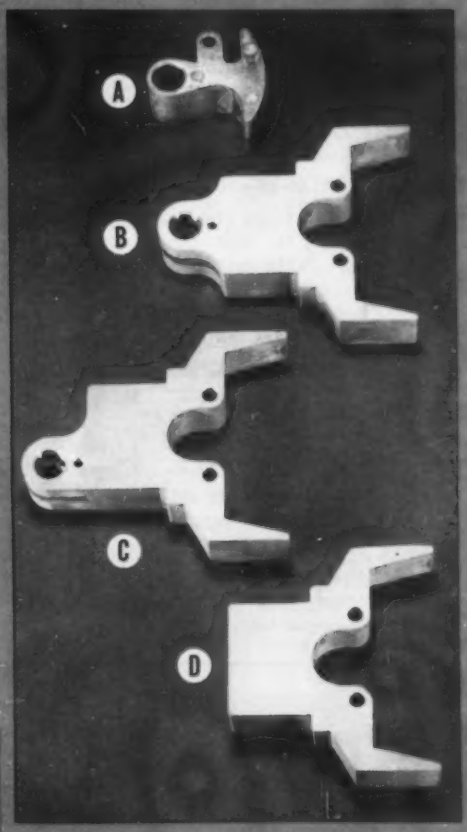
Cover (figure 1e). All that's necessary is to mill the dovetail and the slot in the stud.

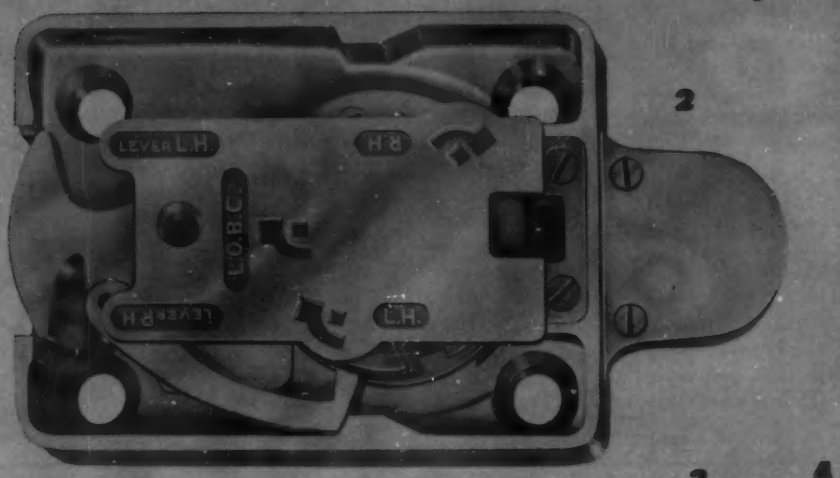
Shaft Plate (figure 1b). Houses a train of three gears which convert the direct drive of the dial into an indirect drive. This is a burglar proofing device since a direct dial system can be punched

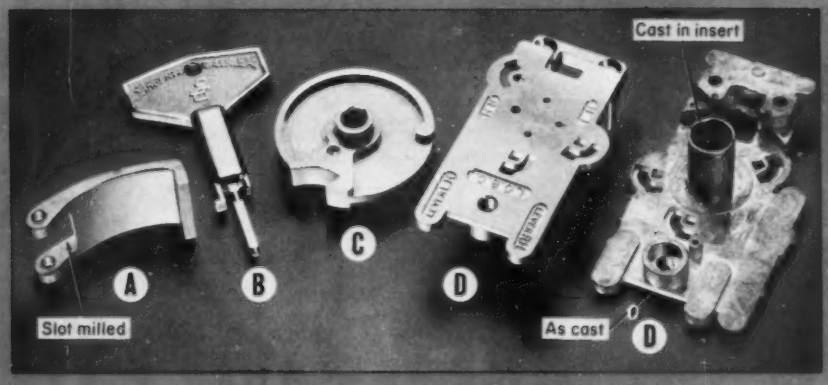


1. HOUSING MEMBERS for the lock. After trimming only minor machining is required.

2. HERE'S HOW one combination of the lock assembles.







3. INTERNAL WORKING members of the lock. The extruded brass lever is part A.

4. FIVE DIE CAST bolts add to the lock's interchangeability.

through. The shaft plate can be mounted on the back of the case in any of three directions depending on how the lock is to be mounted on the vault. The only machining necessary is to tap two holes, and bore the gear holes.

Wheel Post Bridge (figure 3d). Supports the wheels and also supports the key for changing combinations. Cast-in lettering on the bridge clearly marks the correct hole for changing the combination. The only machining necessary is to counterbore one hole. The brass wheel post, (figures 2 & 3d), is a cast-in insert. A ⅜" O.D. washer placed at the bottom of the insert keeps metal from flowing up the two side grooves of the insert during casting.

Extension Plate (figure 1c). Serves as a fill piece for the shaft plate, depending on how the shaft plate is mounted. Trimming completes its machining.

Five Bolts (four of which are shown in figure 4). Can be used interchangeably in the lock.

Roller Belt (figure 4a). The holes are reamed.

Sliding Bolt, Center Extension (figure 4b). A multiple locking bolt. Two holes are reamed and the ear sides milled.

Sliding Bolt, Upper Extension (figure 4c). A dual locking bolt. Machining is the same as bolt B.

Sliding Bolt, Lower Extension (figure 4c). The same as bolt C. The bolt is inverted in the lock.

Sliding Bolt, Square End (figure 4d). A single locking bolt. Machining the same as the other sliding bolts.

Gear Cover (figure 1a). Covers the drive gear, which is in the radius on the shaft plate. Trimming is all that's needed.

Cam (figure 3c). Actuates the wheels that throw the bolt open or shut. The surfaces are faced and the center hole is tapped.

Bolt Throw Block (not shown). Works in conjunction with the cam and requires only trimming.

Nine castings are cast in a unit die.

The unit die

Complete use is made of the advantages of a unit die. The figure on page 34 shows the complete gate of nine castings that make up the lock. With each 10 lb. shot of zinc, the company has all the basic castings needed to make one lock. In addition, the bolt style needed for a given order can be changed by inserting the correct loose piece in the die. This eliminates the necessity of having to have a separate die for each bolt style.

Other parts used with the lock are the die cast key, (figure 3b), and the extruded lever, (figure 3a). The lever is extruded in SAE 72 brass. It drops into the wheel as the gating is aligned and with the cam draws the bolt. After being cut to length, the slot, (figure 3a), is milled and two holes are drilled. The key, used in changing the lock combinations, has a cast handle with a cast-in steel insert. The handle carries the company's name and has an attractive pebble finish cast in. After trimming, the key is ready to receive the chromium finish.

For manufacturing reasons some tolerances are held as close as ± 0.002 during casting. Compare that to usual casting tolerances of ± 0.005 to ± 0.007 and you again see the versatility of the die casting process. Where extremely close tolerances are required the part is machined.

Through all of the design of this lock, major emphasis was placed on reliability first and low manufacturing cost second.

But die casting gave the designer another great advantage which no other economical manufacturing method could give. This is almost unlimited freedom of design, because die casting puts metal where you want it, and nowhere else.

(For finishing these castings see page 37.)

ALL SIZES—LARGE to MIDGET----

ONE SOURCE---DOLLIN

You don't need two sources to get large and very small die-castings. DOLLIN has the specialized equipment and experience to produce both. Large aluminum and zinc castings are produced on latest-design, high production machines. Midget zinc castings are made on Dollin-designed high-speed, automatic equipment, with low tool cost and low piece prices.

Submit prints or samples of parts for engineering advice and quotation, or call in a Dollin representative. Write for facilities brochure.

DOLLIN CORPORATION, 614 So. 21st Street, Irvington 11, N. J.

Sales Offices: Buffalo • Canton • Chicago • Dallas • Detroit • Greensboro • Houston Louisville • Memphis • Philadelphia • St. Louis • St. Paul • St. Petersburg • Windsor, Conn.

See "Yellow Pages" for nearest office.

DOLLIN Zinc and Aluminum DIE-CASTINGS

Circle No. 26 on Reader Service Card

FINISHING

Vault locks are many times used in damp places, such as a basement. To prevent corrosion, the universal vault lock is given a satin nickel finish on the outside. The working parts are nickel plated.

There are two reasons for using a satin finish. It dulls the gloss of the nickel plate reducing the possibility of light reflection. It's attractive.

The outside surfaces of the case, cover, shaft plate, extension plate, and gear cover, are fine belt ground. This removes the skin of the casting and provides a smooth satin appearance. Then order:

1. The castings are vapor degreased in a trichlorethylene solution for two to three minutes.
2. The castings are then racked and put through a alkaline electro-cleaner for two minutes.
3. Water rinse.
4. Hydrochloric acid dip.
5. Water rinse.
6. Copper strike–3/10 thickness at 160° F. for one minute.
7. Copper plate–3/10 thickness at 140° F. for fifteen minutes.
8. Water rinse.
9. Nickel plate–2/10 thickness at 140° F.
10. Cold water rinse.
11. Hot water rinse.
12. Dry.
13. Satin finish the outside surfaces only with a hand buffing wheel.

Grafo COLLOIDAL DISPERSIONS
make jobs easier, smoother, better

and many other industrial applications

GRAFO answers the problems of excessive temperatures, pressures or abrasions. Try GRAFO Colloidal Graphite Dispersions in your **forging** operations, or for better metal flow in **extruding** or **die casting.** GRAFO prevents sticking and reduces die wear. There's a GRAFO Water, Oil or Alcohol Dispersion for every industrial need.

Send for booklet "The Biggest Ounce of Protection."

GRAFO COLLOIDS *Corporation*
289 Wilkes Place, Sharon, Pa.

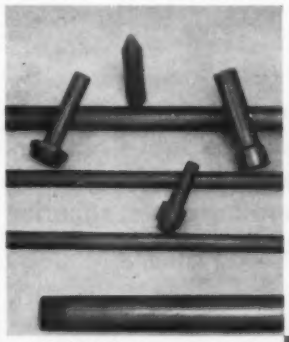
Circle No. **29** on Reader Service Card

Q WHAT ONE MATERIAL

can be used up to 3000°F—is nearly impervious to abrasion and corrosion—can be formed to ± .005 in./in.—and even withstands molten aluminum?

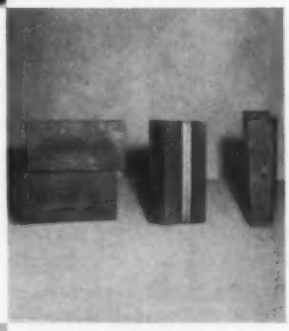
A **Carborundum's nitride bonded silicon carbide — REFRAX® refractory**

This extra hard, very strong material looks like cast iron—wears like no other known refractory or cement—yet costs little more than standard silicon carbides. And it's worth?—you judge from the examples below.



EXAMPLE: Cast iron pyrometer tubes immersed in molten aluminum average 70 hours' life. When replaced with REFRAX tubes, life is *ten times* longer. Iron pouring spouts in molten aluminum cut out in an hour. Contamination of the melt is "distinct." Life of REFRAX spouts is often several hundred hours...and there's no longer contamination.

EXAMPLE: REFRAX brick, rectangular or with tongue and groove, used in hot walls are easy to clean and maintain, resist NaCl, KCl and cryolite fluxes added to metal, speed up heat conductivity and extend wall life. Life of REFRAX hot walls consistently proves to be several times that of fireclay walls.



EXAMPLE: Automatic precision pouring of molten aluminum is governed by REFRAX float that serves as the "nerve end" of electronic system. Refractory float is of simple design, requires practically no maintenance and provides a life 4 to 5 times that of floats made of other materials.

The successful development of REFRAX refractory—a ceramic that can be *used like a metal* under conditions that metal parts can't take—is now a service-tested fact. Of equal importance, this product can be made *in a variety of compositions* to fit your particular service conditions... and scaled in cost to your price limits. For details, contact Dept. R-61, The Carborundum Co., Perth Amboy, N. J.

CARBORUNDUM®

Circle No. **16** on Reader Service Card

Now melt your scrap...

and buy less ingot

ALUMINUM SCRAP

(Dealers' buying price f.o.b. New York in cents per pound)

Alum. pistons and struts	6½ — 7
Aluminum crankcase	8½ — 9
1100 (3s) aluminum clippings	11½ — 12
Old sheet and utensils	8½ — 9
Borings and turnings	4½ — 5
Industrial castings	9 — 9½
2020 (24s) clippings	10

ALUMINUM INGOT

(Cents per lb del'd 20,000 lb and over)

95-5 aluminum-silicon alloys	
0.30 copper max.	24.25-24.50
0.60 copper max.	24.00-24.25
Piston alloys (No. 132 type)	26.00-27.00
No. 12 alum. (No. 2 grade)	22.75-23.25
108 alloy	23.25-23.75
195 alloy	25.75-26.75
13 alloy (0.60 copper max.)	24.00-24.25
AXS-679 (1 pct zinc)	23.00-24.00

(Effective Mar. 13, 1961)

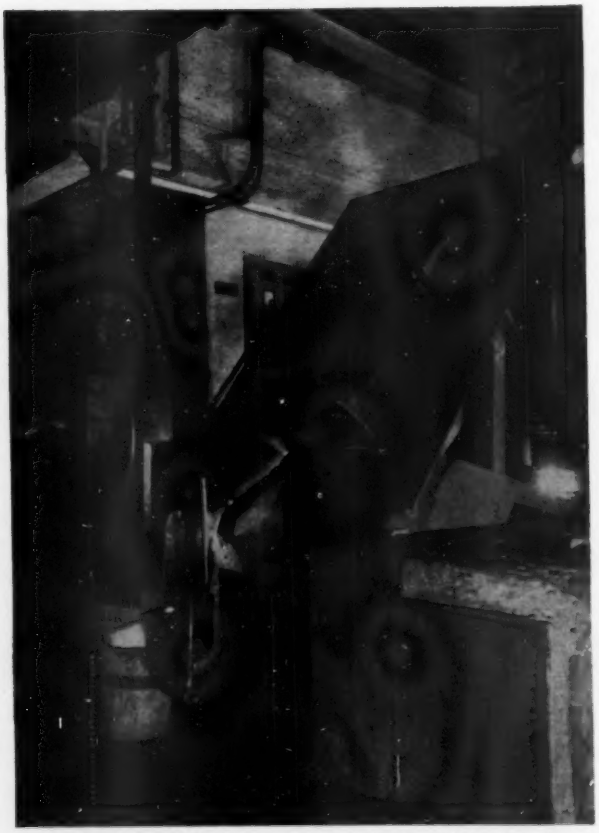
The Brown Boveri coreless line-frequency induction furnace obsoletes fuel-fired furnaces for melting aluminum... offers lower overall melting and operating costs, superior metal, cleaner working conditions.

Here in perfected form from the world's most experienced builder of induction heating equipment is a furnace that makes it *practical and profitable* for you to melt light, bulky aluminum scrap which cannot be used in a fuel-fired furnace because of prohibitive metal losses. *Average losses certified by customer for long-term operation of 8 furnaces melting ingot, chips and machining scrap for aluminum auto parts: 3% based on weight of finished castings compared to weight of metal charged to furnaces!* Losses are even lower when melting ingot and heavy scrap – less than 1% as compared to 7% and higher in fuel-fired furnaces.

Other bonus features that are making this furnace the talk of the aluminum casting industry:

- Higher grade, more uniform metal through precise temperature control and natural stirring action. Highest output per unit – up to 19,000 lbs. per hour.
- Fast alloy changes. Furnace can be emptied and restarted with a cold charge. Uses substantially less flux.
- Clean, cool operating conditions. Virtually no fumes.
- You ram the crucible more easily; less curing time.
- Simple, foolproof design—easy to operate and maintain. One man operates several units. Uniquely suited to full automation.
- No clogging or cleaning of channels with this *coreless* design. No danger from metal freeze-ups and no need to hold heat between shifts and over weekends.

Get the whole story. Learn how this furnace can pay for itself while giving you better metal and better castings. Write today to Brown Boveri Corp., Dept. P6, 19 Rector St., New York 6, N. Y.



Above: a 360-KW Brown Boveri furnace for aluminum with melting rate of 1350 lbs./hr. Hydraulic tilting mechanism provides safety and precise control. Brown Boveri makes a full line of line, medium and high frequency induction heating equipment to assure the perfect mating of equipment to every metal and every application.

BROWN BOVERI

Circle No. 69 on Reader Service Card

GATING ZINC DIE CASTINGS

By **RALPH WILCOX,** *Metallurgist, American Smelting and Refining Co.*

Current practice for gating zinc die castings is being examined in a series of articles. This article is Part II. Part I on gating rectangular shaped castings appeared in the May 1961 issue (pg. 40).

CASTINGS THAT ARE CIRCULAR or tubular require a different gating method from that required for rectangular castings. Figure 5 illustrates a simple circular die casting and figures 5A, 5B and 5C show this casting in plan view as produced in a two cavity die by three different methods of gating. Assume that the casting is produced in a hot chamber die casting machine, gate runners are in the moveable or ejector half of the die and the significant surface to be plated is placed in the stationary half of the die.

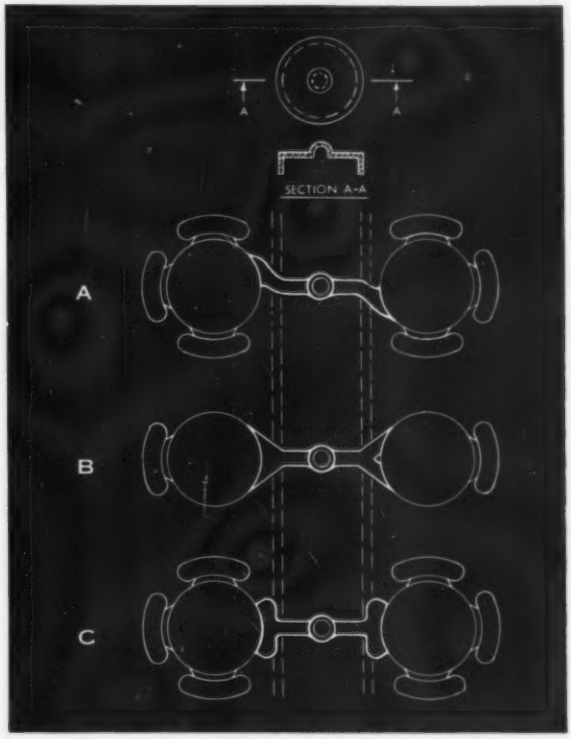
In methods A and B the metal flow is such that the casting cavity is filled from the perimeter inward. As a result, some air is generally trapped in the center area of the casting. Large overflow wells are needed to draw sufficient metal out of the cavity to keep porosity low.

The divider or spreader shown in the middle of the gate on one of the castings in method B is helpful if the gate is to be broken from the casting by hand. It also avoids direct impingement of incoming metal upon a core. If a trimming die is to be used, then the use of a spreader should be avoided since it tends to increase the dilating effect of this type of gate.

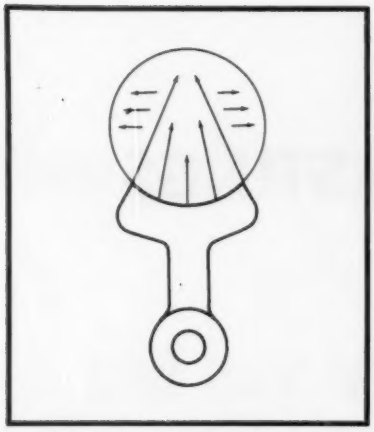
In method C, which is often referred to as an "outside caliper" type gate, the metal flow is more compact and tends to fill the cavity from the center outward as shown schematically in figure 6. Overflow wells are required for optimum soundness as with methods A and B. However, usually a smaller overflow volume will suffice to produce a sound casting.

All three methods permit easy cooling of the gate and runner system. Also, these methods offer no difficulty in removing the gate, runner, overflow wells, and flash by the use of a trimming die. The gate thickness for these methods would probably have to be at least .030" and preferably .035" to .045" if the section thickness would allow.

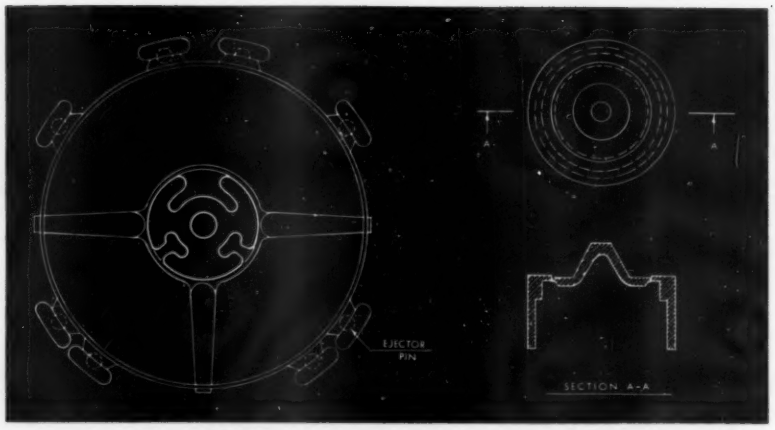
More complicated circular die castings such as automobile horn blowing rings, motor fly wheels, impellers, etc. are best center gated whenever possible by placing the spru and gate in the center opening of the castings. An automobile horn blowing ring gated in this manner is shown in plan view in figure 7. Metal flow is ideal with this type of gate, but it is difficult to cool the gate and runner area except for the sprue itself. The sprue is almost always water



5. A-B-C PLAN VIEW of the zinc die casting (top) is diagramed as it could be produced in a two cavity die by different gating methods.



6. SCHEMATIC DIAGRAM indicates likely metal flow in a circular casting with outside caliper type gate.

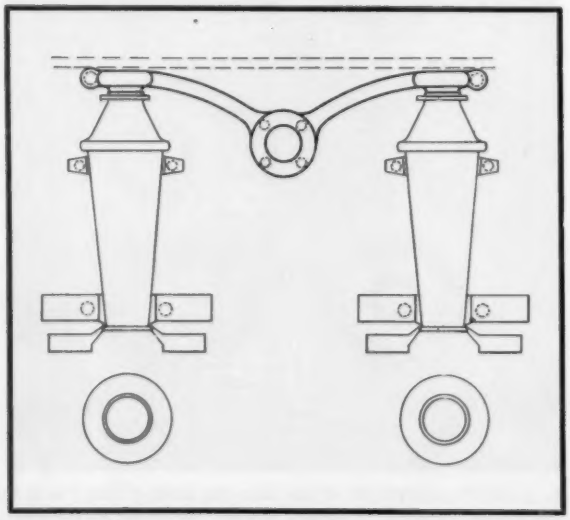


7. DIE CAST automobile horn blowing ring (left) shows center type gate. Circular shaped die casting (right) shows how the sprue, runner and gate fill the entire area of the inner circle.

8. CENTER GATING with least restricted gate runner area.

9. CENTER GATING with four gates takes longer to cool.

10. CENTER GATING with several gates requires precision trimming.

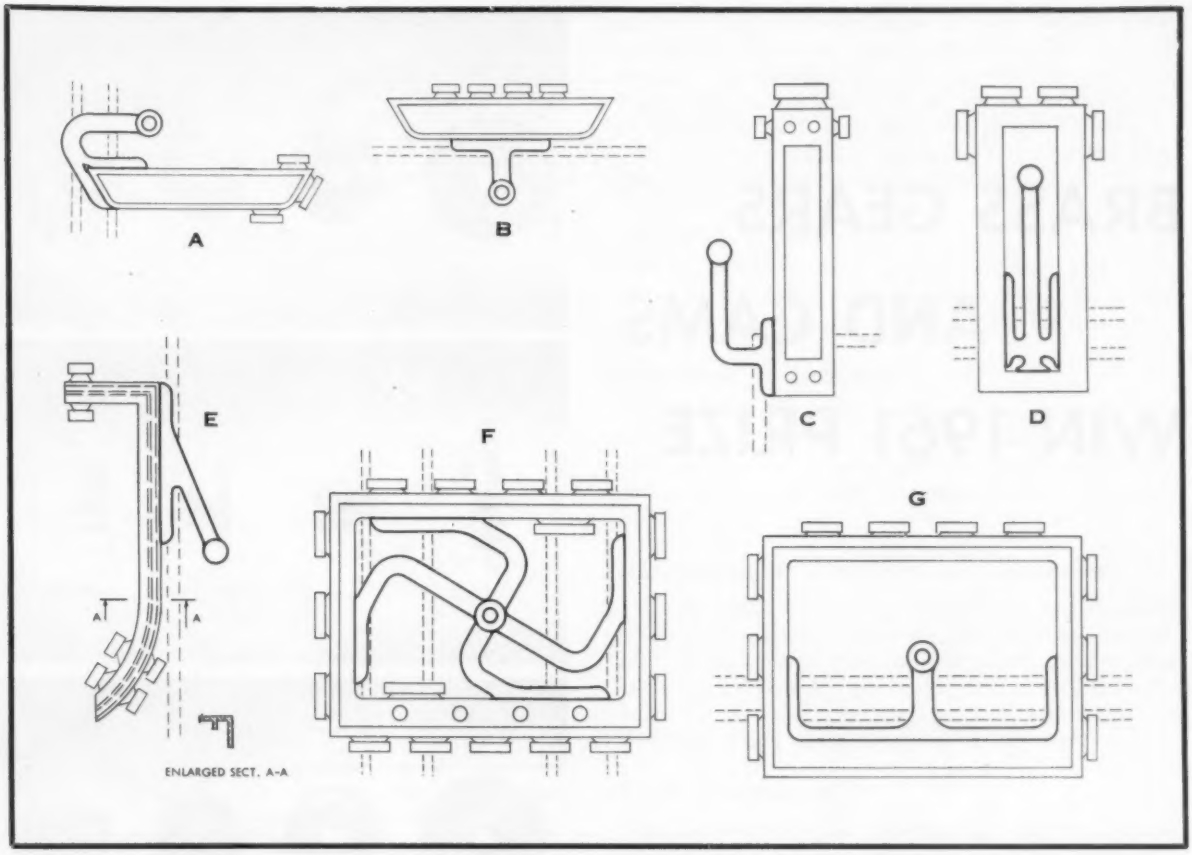


11. TUBULAR DIE CASTING shows application of a ring gate.

cooled where space and size permit through the use of a water cooled sprue bushing and sprue spreader. A gate thickness in the range .035″ to .045″ is usually required, particularly to prevent soldering near the gate. There is a tendency to overheat in this area for lack of adequate cooling.

The gate and runner design shown in figure 7 purposely fails to cover the entire area of the inner circle of the horn ring to minimize localized overheating. However, it is often desirable and sometimes necessary to have the gate and runner cover the entire inner area as shown in figure 7A.

In addition to performing their usual functions, the overflow wells shown in figure 7 also serve as additional ejector pads against which ejector pins push to eject the casting from the die. This is done because (a) the outer ring is not wide enough for a normal size ejector pin to push against and (b) if small, special shaped ejector pins were used these inevitably would leave some flash that would require an extra operation for removal. Note the symmetrical position-



12. A-G EXAMPLES of several methods of gating frames, bezels, panels and housings.

ing of these overflow wells to insure equalized ejection pressure over the entire perimeter.

Three variations of the center gate for circular castings are shown in figures 8, 9 and 10. These are usually used on large circular or oblong castings such as automobile head lamp or tail lamp bezels, clock cases, etc. where the center area is large enough to permit locating the sprue, runner and gate inside the casting. All three methods of gating illustrated are capable of producing satisfactory castings. However, the gate design in figure 8 with its restricted gate runner area is the easiest to cool and usually yields the highest production rate.

Removal of the gate, sprue, runner, overflow wells and flash from castings gated as shown in figures 7 through 10 is difficult and is best done with a carefully designed and constructed trimming die.

Still another method of gating circular or tubular shaped castings is by the use of a ring gate. This is shown in figure 11. Note that two of the overflow wells also serve as ejector pads and that other ejector pads have been added where needed. The dotted circles show likely locations of ejector pins in the moveable or ejector half of the die.

The ring gate has many advantages, but its big disadvantage is that it must be removed by sawing or with a cutting tool in a lathe. The thickness of the gate opening in this design can be anywhere from about .035" to .125" depending upon the size and section thickness of the casting.

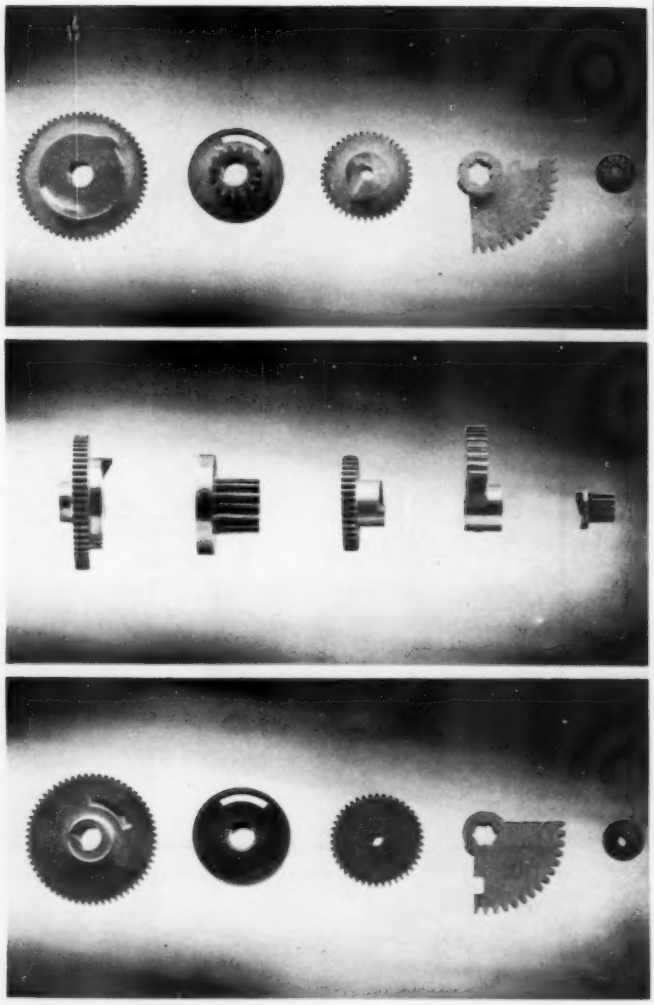
APPLICATIONS FOR LARGE CASTINGS

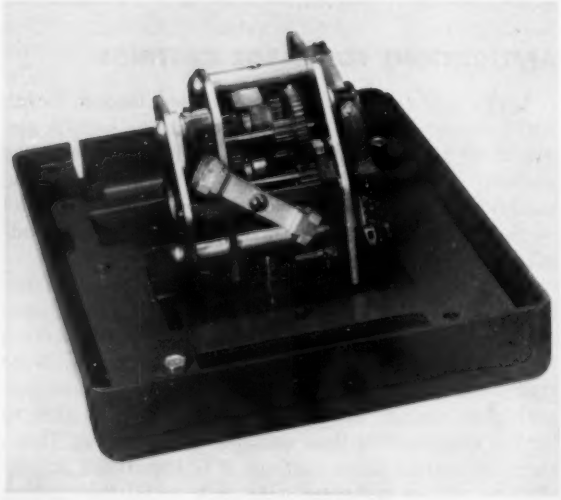
Large square or rectangular shaped frames, bezels and housings up to about 15 pounds in weight and about 40 inches in length and width can be gated successfully by one, or a slight variation, of the several methods of gating already discussed. A few examples of this type of casting with several possible methods of gating are shown in figure 12A through G.

All of these methods of gating have produced satisfactory castings in commercial application. The choice of one over the other depends largely on the section shape and contour of the casting to be produced. Note that some of the methods employ more than one gate and gate runner. In general it is usually better to have a single rather than multiple gate opening. However, on certain large castings it is sometimes impossible to obtain sufficient gate area to fill the casting quickly enough without resorting to multiple gates such as in figure 12F. In these cases it is important to try to keep the metal flowing in one direction so that each gate opening compliments rather than opposes the other.

Part III of this article will appear next month.

BRASS GEARS AND CAMS WIN 1961 PRIZE





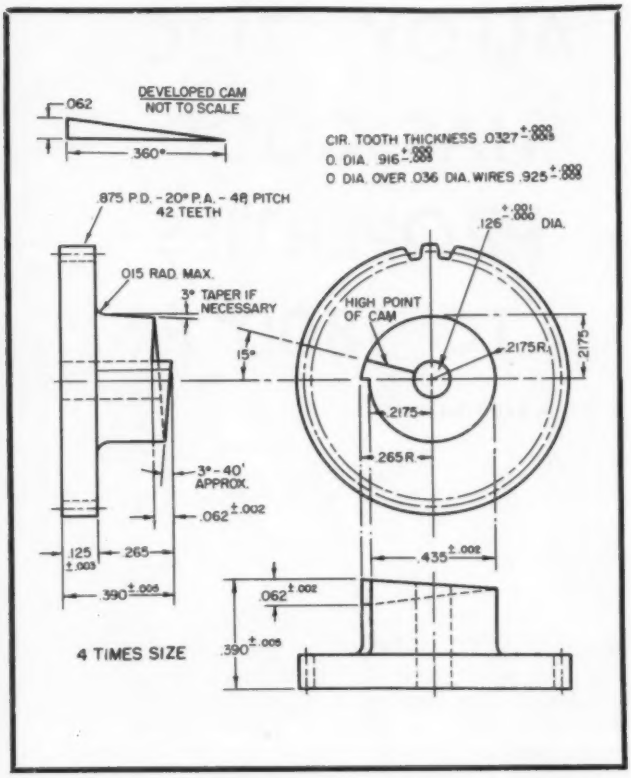
MODERN DESIGN of the fire alarm relies on modern fabricating techniques and the design freedom possible with powder metallurgy.

UNIQUENESS DOESN'T WIN PRIZES as often as sound engineering applications. This was brought out when a combination gear and cam assembly for a fire alarm pull box won the grand prize in the 1961 Nonferrous Metal Powder Part of The Year contest sponsored by The New Jersey Zinc Company.

The designer, Walter F. Schuchard, chief engineer of the S. H. Couch Co., and Alexander L. Alves, president of Engineered Plastics, Inc., worked closely on the design of the gears and cams to take every possible advantage of the properties and economies of powder metallurgy. Old concepts of gear cutting, assembly, and even materials were discarded to take advantage of the design freedom which powder metallurgy permits.

Almost every good design principle of powder metallurgy is exemplified in these parts. This is especially notable when one remembers that this is a product which may not fail. Regardless of how infrequently a fire alarm box is used, it must be in perfect operating condition at all times.

What are some of the features of these parts which won the prize?



DIMENSIONS on the code gear unit cluster show strict specifications that were adhered to. Part would be almost impossible to produce by traditional gear cutting methods.

FIVE PARTS make up the prize winning gear and cam assembly. They are, from left to right, the main gear and clutch cluster, the clutch plate and pinion cluster, the code gear unit cluster, the winding segment and the pinion cam, which mates with the code gear.

Impact resistance

The segment gear winds the spring which operates the signaling mechanism. When the alarm handle is pulled down the spring is wound, and on release of the handle the segment gear slams back against the die cast box. Failure by impact would destroy the operation of the alarm.

Wear resistance

The camming surfaces determine the signal given by the alarm. Any wear on these surfaces could cause a faulty signal so that the wrong box location would be recorded in fire control headquarters.

Combination of pieces

All of the gears show how powder metallurgy is able to combine two or more parts which would need a separate assembly operation.

Special shaft locking

Most of the gears rotate freely on their shafts. The segment gear, however, may not slip or the drive spring would not be completely wound. At little, if any, extra manufacturing cost, a specially shaped hole is provided in the sintered part which would require an expensive breaching operation in a cut gear.

The spring retaining notch in the segment also eliminates a separate milling operation.

Low scrap losses

If an assembly were to be eliminated and gears made by traditional methods, there would be a very high scrap loss just to provide hubs on the gears.

Elimination of machining

Complex milling and contouring operations have been avoided through the use of powder metallurgy. Some of the cam shapes would have to be materially changed to even allow manufacture by any other method.

Maintenance of dimensions and tolerances

If the tools for making these parts are carefully made and properly cared for, the dimensional stability from part to part will be much greater than could be secured by machining and assembly methods. In most cases, tolerances are well within the normal production limits for powder metallurgy.

Tooth modification

In some of the gears there is a very high load on the teeth. This has been compensated for by a slight modification in tooth form to give a heavier root with consequent increased beam strength.

For more information on the design of gears to be made by powder metallurgy methods, the reader is referred to the article by T. L. Robinson starting on page 24 of this issue. This is the first of a two part article on gear design. The second part of the design article will appear in the July issue.

SCHUCHARD

ALVES

WALTER F. SCHUCHARD, *chief engineer of the S. H. Couch Company in North Quincy, Massachusetts, was one of the men most responsible for the design of the Grand Prize winning powder metal parts, and* ALEXANDER L. ALVES, *president of Engineered Plastics Incorporated in Watertown, Connecticut, accepted the prize awarded the fabricator for turning the blueprints into precise, highly functional parts.*

- ▶ Up to 300 PIECES PER MOLD
- ▶ UP to 80,000 PIECES PER DAY
- ▶ TOLERANCES for CRITICAL DIMENSIONS to ± .003
- ▶ SURFACE FINISHES AS CAST to 125 MICROINCHES or BETTER
- ▶ BURN-OUT, BREAK-OUT and CUT-OFF TIME CUT IN HALF
- ▶ FULL RANGE OF NONFERROUS ALLOYS for EXCEPTIONAL STRENGTH, CORROSION RESISTANCE and LIGHT WEIGHT.

write or phone for complete information . . . prints will bring a prompt quotation

ATLANTIC
CASTING & ENGINEERING CORP.
810 Bloomfield Avenue / Clifton, N. J. / PRescott 9-2450

Circle No. **79** on Reader Service Card

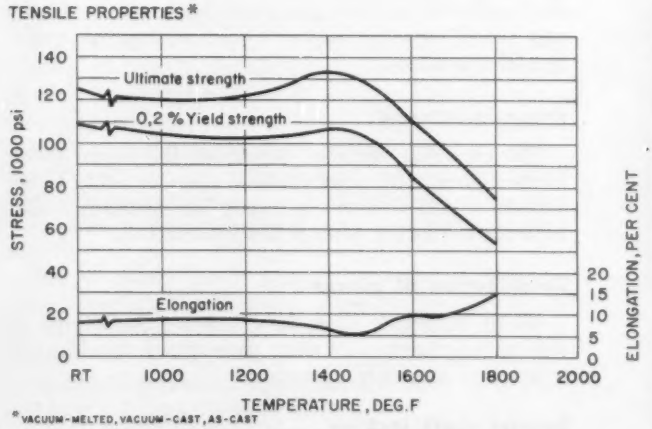
ALLOY "713C" HAS GOOD PROPERTIES TO 1800° F

By **F. KENNETH IVERSON**[1]

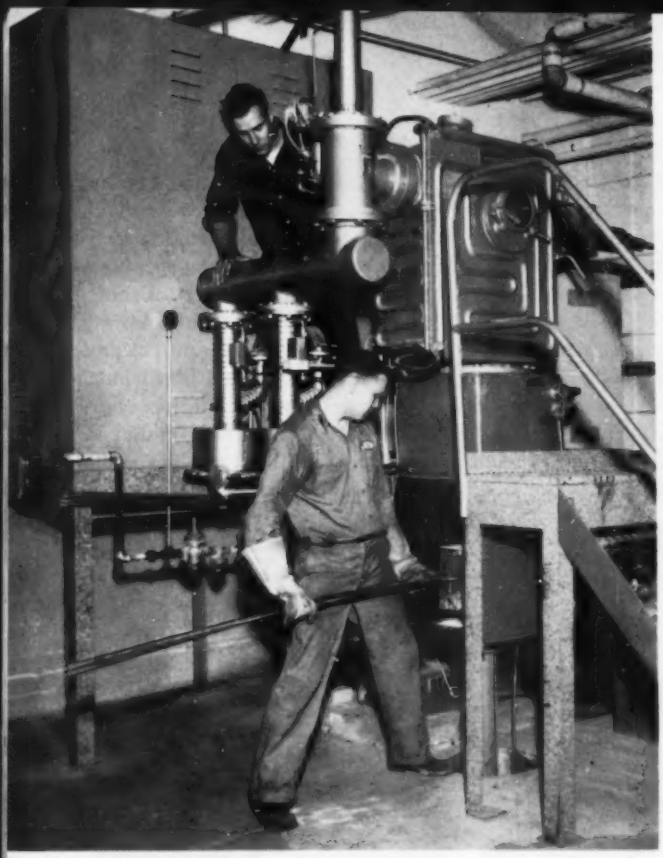
ALLOY "713 C", developed by International Nickel Co., is a precipitation hardening, vacuum melted, nickel base alloy. It helped to extend the operating range of nickel base alloys to 1700°F-1800°F. The composition is:

.08	-	.20	Carbon
11.0	-	14.0	Chromium
3.50	-	5.50	Molybdenum
1.50	-	2.50	Columbium & Tantalum
5.50	-	6.50	Aluminum
.35	-	.90	Titanium
.05	-	.20	Zirconium
.005	-	.02	Boron
Balance			Nickel

Inco 713C possesses outstanding creep rupture strength, resistance to thermal fatigue and high



2. ELEVATED TEMPERATURE tensile properties of 713C alloy.

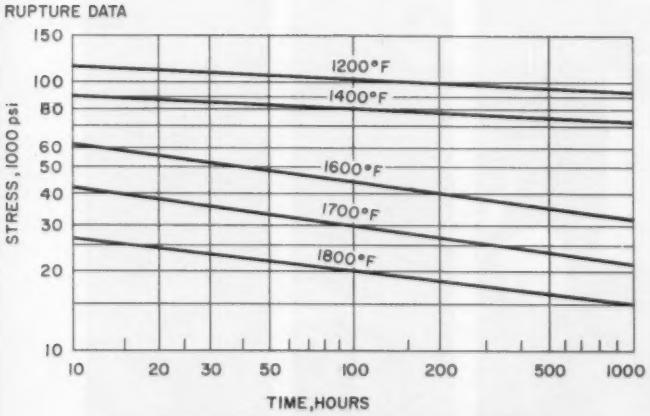


1. TWENTY-POUND VACUUM FURNACES at Misco Precision Casting Co. are used in the production of 713C investment castings.

oxidation resistance up to 2000°F. The elevated temperature tensile and creep rupture properties are shown in figures 2 and 3 respectively. No heat treatment is required to develop these properties.

The alloy has a melting range of 2350°F to 2450°F. Under vacuum melting conditions the fluidity, cleanliness and pouring characteristics are excellent.

Investment castings weighing as much as 100 lbs., with intricate cored sections are readily produced.



3. CREEP RUPTURE properties of 713C alloy.

Typical castings include turbine blades, nozzle wheels, and combustion chambers. Examples of the large complex castings produced are shown in figures 4 and 5.

Figure 1 shows a twenty pound vacuum melting furnace of the type used in the production of investment castings of Inco 713C.

Machining on Inco 713C requires sturdy machines and cutting tools to prevent tool breakdown. Electro-Spark, Electro-Arc and Ultrasonic machining methods can also be used.

Grinding operations must be performed with care. Variation in the grinding procedure causes wide variation in results. Generally, a grinding wheel with low hardness and an open grain structure is recommended. Good results can be obtained with a high work traverse speed (over 75 fpm) but a low grinding wheel peripheral speed (3300-4500 surface feet per min.) and a low wheel feed are desirable.

Inco 713 has a moderate degree of weldability. Crack-free welds, under conditions of low restraint, can be produced on sections up to ½" thick. However, cracking is encountered where restraint is present.

---

[1]Mr. Iverson is now executive vice president, Coast Metals, Inc. Formerly he was manager of sales, Cannon-Muskegon Corp.

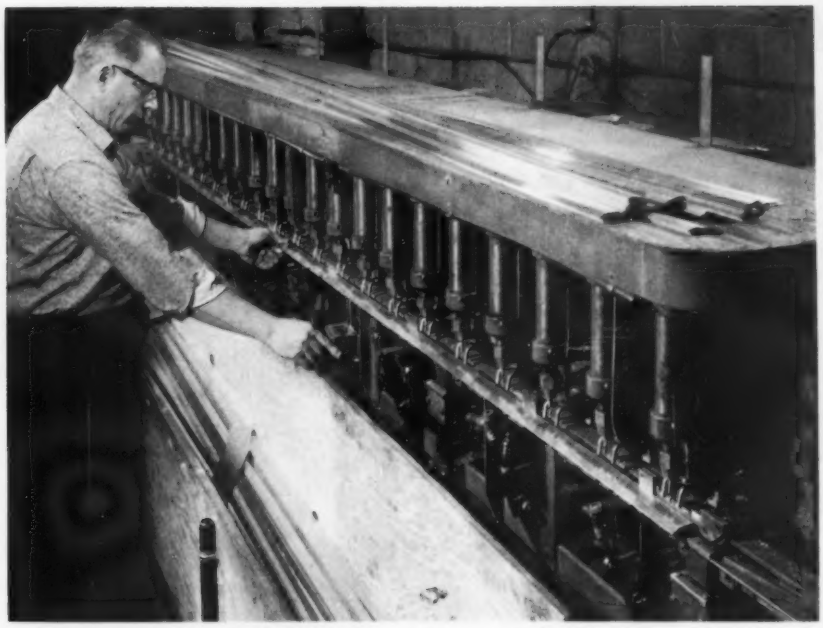
4. LARGE TURBINE BLADE is a typical example of what parts can be cast in the new alloy.

5. TURBINE NOZZLE produced from Inco 713C.

ADD THIS SPECIALIST to your barrel finishing team

Your Carborundum Barrel Finishing Specialist can become an important means of cost reduction in your plant. He is trained in the most modern barrel finishing techniques. He has had practical experience in many plants where he has helped demonstrate that barrel finishing, properly applied, can produce precision results at low cost. He can advise you on the correct equipment and methods for deburring, grinding, polishing, burnishing, radii-forming, cleaning, descaling and many other operations which you might require. Put this specialist in your finishing picture... phone your local Carborundum distributor or district office. **CARBORUNDUM**

Circle No. **73** on Reader Service Card



1. TO HOLD COSTS DOWN, up to twenty holes can be drilled and countersunk.

MACHINING AND SURFACE FINISHING EXTRUSIONS

By **FRANK STARZYK,** *General Manager, Superior Industries, Inc.*

A LOT OF THE EXTRUSIONS we make go into decorative trim. For these applications the as-extruded or mill finish isn't good enough. That's why we have buffing, polishing, anodizing, and painting facilities in our plant. We can also do drilling and countersinking, cut-off, minor milling, punching and notching, and some bending.

Drilling and countersinking

We have three multiple head drilling machines. Each one will handle an extruded shape up to 20 feet long and as many as twenty holes can be drilled and countersunk in a single operation. One of the machines is shown in figure 1.

Depending on customer requirements, we can tool this machine for any hole spacing required. The shape is held on a flat bed by air clamps. The air powered drill heads are then lowered and the holes drilled and countersunk in a single operation.

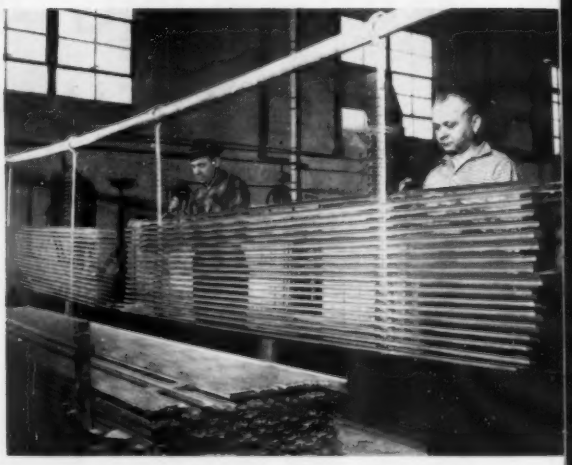
When necessary, the extruded shape can be moved so that another set of holes can be drilled. In this manner, any required center distances can be gotten. By using very high speed tools and a moderate feed there is practically no problem with burrs.

These machines can, of course, only be used when production quantities are large enough to warrant the set-up and tooling charges. For shorter runs we generally use a standard drill press equipped with a multiple-drill head. With a simple jig this machine can be set to drill and countersink on any desired center distance. Labor charges are higher with this type of equipment, but tooling is very inexpensive.

2. ACCURATE, SQUARE cut-off is easily done with a precision cut-off machine. Customer specifications are exactly met.

3. EXTRUSIONS CAN BE BENT and on low production jobs a hand bending jig is often used.

5. BUFFING AND POLISHING long pieces requires a mandrel and supporting members. It's still easily done.



Notching and punching

When non-round holes are specified we will either notch or punch, depending on the hole requirements. For high production jobs a 12 foot press brake is used on which tooling can be set every few inches. As in the case of the drilling machine, movement along the bed of the machine lets us punch to very short center distances.

When low production jobs are involved it seldom pays to tool up on a large press. For such work we generally use a single station press equipped with a jig to allow fast, accurate positioning.

Deburring, after punching operations, is less of a problem than drilling. However, a well made, properly cared for tool reduces the burring materially.

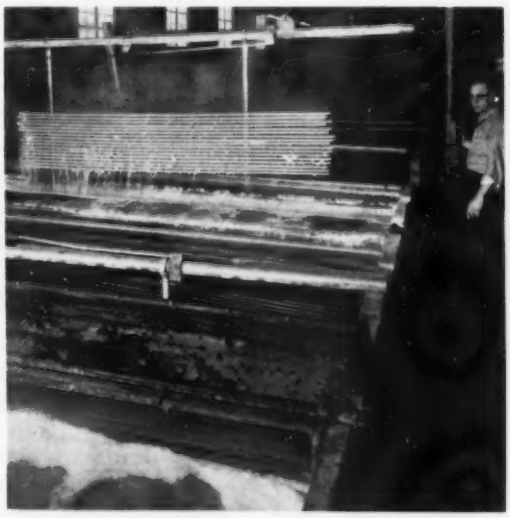
Cutting to length

Many of our customers specify extrusions cut to other than standard mill length. When the cut is at 90° to the run of the extrusion we use a standard cut-off machine, like the one shown in figure 2. When some angle other than 90° is required a mitre saw is used. Generally, the only other cut is at 45° for right angle corners.

Bending

There are many applications for extrusions where bending is required. As in the case of other operations

4. FOR BUFFING and polishing short pieces, a standard lathe is used.



7. THE ETCH BATH is one of the essential steps in applying a satin anodized finish.

6. LONG EXTRUSIONS are racked for anodizing so that the finished surface is uniformily treated and drains easily.

described, the equipment used will depend on the quantities involved. The operation shown in figure 3 is a low production one. A hand operated bender is, therefore, employed. On high production work semi-automatic or fully automatic machines are used.

Buffing and polishing

When a bright finish is required, the extrusions must be buffed and polished. This is true whether the aluminum is to be anodized or not.

Most buffing and polishing is done after any machine operations, including cut-off, are finished. However when a customer wants to avoid punched holes from washing out, then buffing and polishing is performed before fabrication and touched up afterwards. When fairly short sections are involved, standard polishing lathes like those shown in figure 4 are used. The kind of wheel and the compound used will depend on the alloy and the required finish.

For longer sections, the lathes are modified as shown in figure 5. Sections six or more feet long can be handled on this type of set-up.

When production quantities warrant, extruded sections may be buffed and polished on straight line automatics. Generally, short sections work best on automatic machines though it is possible to handle lengths up to 20 feet if necessary. The odd complex pieces require special machine set-ups and can only be done on very large production orders.

Anodizing

Almost all of the extruded aluminum sold for trim use is anodized; the majority of it is bright finished.

Cleaning

In all cases the first step is cleaning. This is primarily removal of any residual lubricant from the aluminum shape. A solution of a detergent in water at 140°F is used and the racked parts (figure 6) are immersed from six to eight minutes. This solution serves to loosen soil of all sorts which has accumulated on the metal surface.

First rinse

Following cleaning the racked parts go to a two stage cold water rinse. In the first stage a high pressure spray is used. This serves to remove the loosened soil and gives a rapid removal of all detergent solution which might spot the metal. In the second stage, immersion in cold water is used.

Etch

Parts which are to be satin anodized now go to an etch tank. The solution here is 200 lbs. of caustic soda in 1800 gallons of water. The solution is held at 120°F and may contain a small amount of a buffering solution to prevent rapid chemical action along short edges. The time in the etch tank will vary depending on customer finish requirements. The usual time for trim metal is from five to six minutes. This time may be extended to as much as ten minutes to get special finishes. The etch is followed by a rinse in cold water.

Anodizing

After etching, the metal goes directly to the anodizing tank. Here the solution is sulfuric acid, 220 gallons of concentrated acid in 1800 gallons of solution. Anodizing temperature is held at 75°F. Anodizing is done at 20 or 10 AMPS per square foot volts and time in the tank will vary from ten minutes to thirty minutes. In general the longer the metal is in the anodizing tank the better the anodize coating.

After anodizing the metal is again rinsed in cold water.

Sealing

The final step in a satin anodizing operation is sealing. This is done in hot (210°F) water. Time in the

Capable, Dependable Economical . . .

Casting Engineers

Investment Castings For Industrial and Military Applications

Casting Engineers has earned an outstanding reputation for helping designers and manufacturers solve engineering and production problems. On-schedule deliveries of uniform, high-quality castings keep production lines operating. Casting Engineers' complete multi-plant facilities and exclusive production techniques assure prompt supply at low unit cost.

Casting Engineers has demonstrated its ability to cast precision components in over 100 alloys . . . steel, copper-base, aluminum or "exotic". Whether your application requires our high-volume Minicast process for relatively-small parts or the newer Monocast ceramic shell technique for larger pieces, Casting Engineers guarantees maximum production efficiency.

A competent staff of design, mechanical and metallurgical specialists makes Casting Engineers your best single source of supply for castings in *any* application.

Write today for application brochure and technical data for designers!

Casting Engineers

PLANTS IN CHICAGO AND NEW YORK CITY

2321 N. BOSWORTH AVE. • CHICAGO 14, ILL.

BUckingham 1-2940

MINICAST

MONOCAST

Circle No. 75 on Reader Service Card

sealing tank is ten minutes. When the water used in sealing is hard it may be necessary to put in a little sulfuric acid, say three or four gallons in an 1800 gallon tank.

After sealing the shapes are dried, inspected and packaged for shipment.

The anodizing procedure described is for a satin finish only. Two modifications are frequent.

Bright anodize

When a bright anodize is required the parts may be buffed and polished before anodizing and then go through all of the steps described above except etching; this is omitted.

In some cases where buffing and polishing is not required the racked shapes are given a bright dip or chemical polishing treatment instead of etching. The quality of bright finish may not be quite as good as with buffing and polishing, but for some trim applications where the exposed surface is narrow, this is entirely satisfactory.

Coloring

At present, the only coloring we do is gold anodizing. This can be done on bright or satin anodized work and involves the extra step of dying after anodizing and before sealing. The dye tank is held at 120°F and the time and amperage will vary depending on the shade of gold desired. After dying the shapes go to the sealing tank and then to shipment.

Painting

Many extrusion customers, particularly appliance people who have us cut and light machine the shapes require some painting. This may be an overall cover job where trim must be colored or it may be simply silk screen design or color filling in depressed lettering.

Whenever painting is required on unanodized metal first, the metal is cleaned. The standard detergent cleaning and double rinse is adequate. The metal is then spray painted, silk screen decorated or depressed letters are filled. For special designs or for non depressed lettering paint spray masks may be used.

When a better finish is required the metal is given a satin or bright finish anodize first and then painted. This gives a better tooth for the paint and provides additional corrosion protection in case of paint failure.

We have not found any cases where it is necessary to use a chemical conversion coating under the paint. Anodizing does as well and, for us, is much simpler and more convenient.

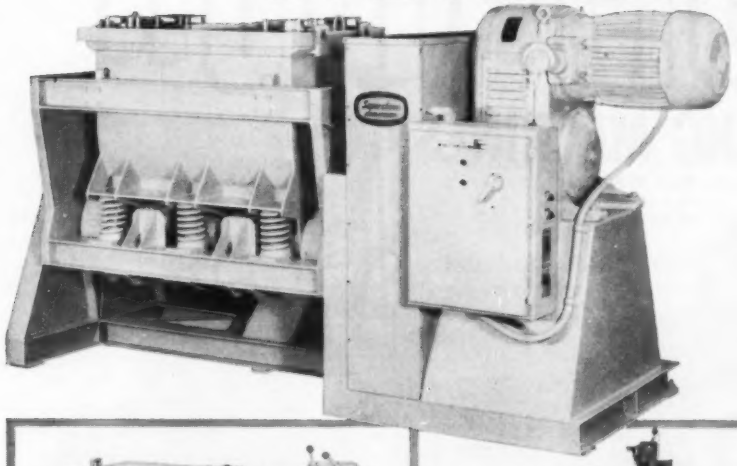
The type of paint used is generally specified by our customers. For this reason, build up per pass, drying time and baking time and temperature will vary.

Inspection of the painted surfaces also varies widely. In many cases it is simply visual, in other cases the inspector may try to break the painted surface with either a pencil or a fingernail. Of course in some cases, around a kitchen sink for example, more severe testing is done and the painted surface must stand reasonable exposure to different detergents and to chlorine containing bleaches.

UP TO 100 TIMES FASTER FINISHING WITH

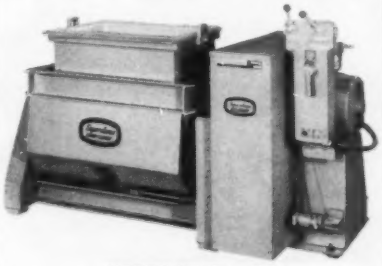
ALMCO

VIBRASHEEN



ALMCO'S FULL LINE OF NEW VIBRASHEEN MACHINES

MODELS VT-717 — 712
(18 and 12 cu. ft. capacities)
Ideal for large components requiring fixtures or a large volume of smaller parts.

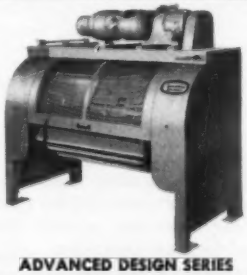


MODELS VT-77 — 75
(7 and 5 cu. ft. capacities)
Efficiently deburrs and finishes parts in quantities suitable for medium size production runs.

MODELS VT-72 — 71
(2½ and 1 cu. ft. capacities)
Popular unit for firms requiring precise finishing of a wide variety of parts in small lots.

MODEL VT-70
(3 Qt. capacity)
Bench model ideally suited for miniature bearings, extremely small gears, stampings, etc.

WORLD'S LARGEST LINE OF PRECISION FINISHING EQUIPMENT



ADVANCED DESIGN SERIES
Thirteen models are available in this series featuring capacities of from 5 to 40 cu. ft., each equipped with variable speed drives. (Infinite from 6 to 30 rpm's.)

SPINDLE MACHINES
Designed for fast precision finishing of complex, high quality components such as gears, bearing cages, spline shafts, rotors, on continuous production "in line" basis.

CUSTOM DESIGN BARRELS
Special large diameter barrels are available to accommodate extra large parts. Fixtures hold parts to assure complete, precise finishing of all crevices and surfaces.

SEND FOR NEW ALMCO CATALOGS ON BARREL FINISHING MACHINES MEDIA, AND COMPOUNDS

ALMCO
Supersheen

Queen Products Division Of King-Seeley Thermos Co.
76 **Marshall Street • Albert Lea, Minn.**

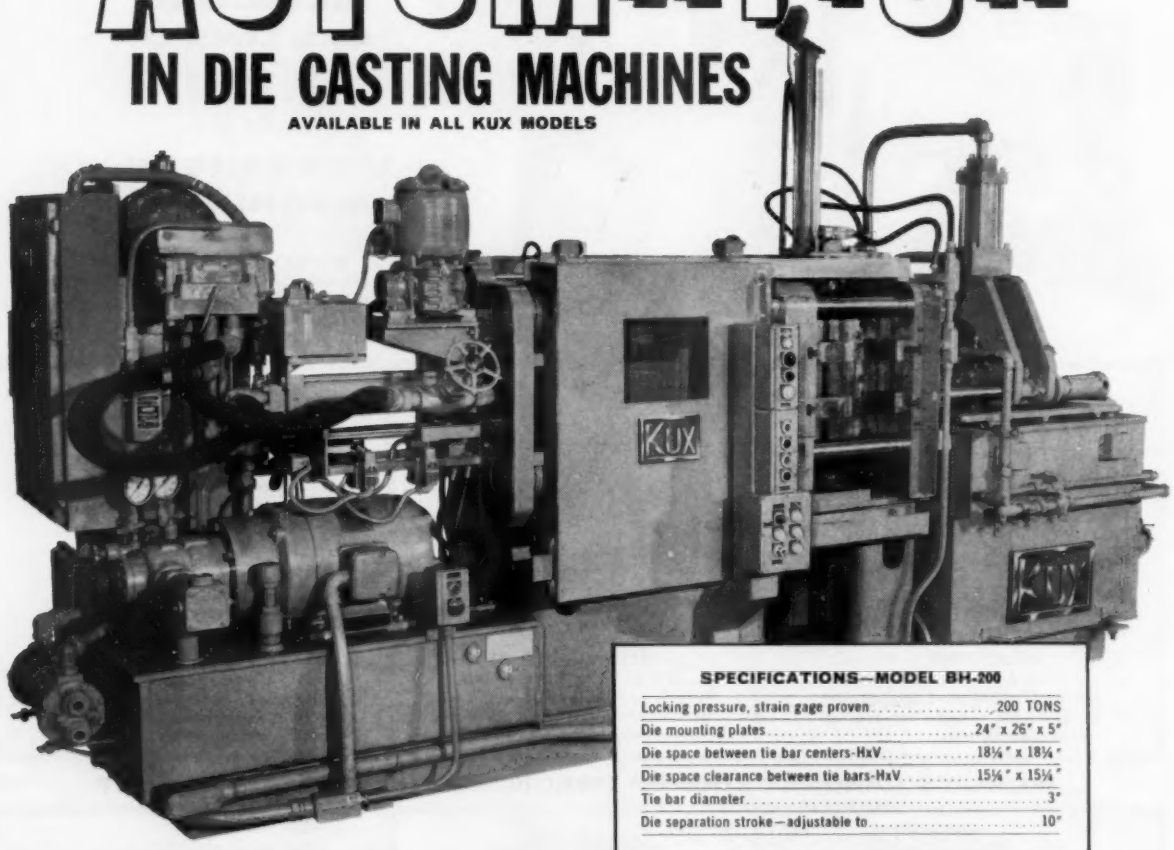
Circle No. **70** on Reader Service Card

Another **KUX** unsurpassed design superiority

AUTOMATION

IN DIE CASTING MACHINES

AVAILABLE IN ALL KUX MODELS



SPECIFICATIONS—MODEL BH-200

Locking pressure, strain gage proven	200 TONS
Die mounting plates	24" x 26" x 5"
Die space between tie bar centers-HxV	18¼" x 18¼"
Die space clearance between tie bars-HxV	15¼" x 15¼"
Tie bar diameter	3"
Die separation stroke—adjustable to	10"

Up to 900 free cycles per hour . . .
500 to 700 casting cycles per hour } AUTOMATICALLY — CONTINUOUSLY

You're looking at the new KUX Model BH200—the 200-ton strain gage proven hot chamber die casting machine, which will continuously produce vast quantities of hardware finish castings with minimum maintenance and down time. Automatic operating mechanism permits a cycle with a full 10" of die movement and 6" of metal injection stroke in 4 seconds. A 6¼ lb. zinc shot can be produced in this heavy duty machine at 1800 PSI injection pressure. Sensing safeties retract the die plate and prevent recycling of machine if there is flash on the die surfaces.

Incorporated into this machine cycling mechanism is a low pressure approach of the moveable die plate, flash sensing switches, air jets for cleaning die faces, casting sweep arm, and die lubricating unit with adjustable interval timing. Also available in cold chamber models for casting aluminum with KUX "AUTO-FEED" system of vacuum die casting.

ADDITIONAL FEATURES in the 28 all-new strain gage proven KUX models are the revolutionary "VAC-U-DIE" and "AUTO-FEED" systems of vacuum die casting—motorized die height adjustment mechanism—and the patented KUX injection pressure multiplier for cold chamber models with injection pressures up to 36,000 PSI and plunger speeds up to 12,000 inches per minute.

KUX MACHINE CO. (Dept. P)
6725 North Ridge Avenue, Chicago 26, Illinois

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.
Circle No. **40** on Reader Service Card

PMM

data offered in this month's ads *qualified readers may obtain any of these free reference materials by circling the numbers on the reader service cards*

1. **Steel Finishing Balls**—Abbott Ball Co.—Technical bulletin AP-1 describes barrel finishing media for producing mirror-like finishes.
2. **Lubricants**—Acheson Colloids Co.—Bulletin No. 425 describes lubricants used in metal casting, includes Dag 193 for permanent mold casting.
3. **Iron Powders**—Alan Wood Steel Co.—Literature on custom blended iron powders.
11. **Investment Casting**—Arwood Corp.—48-page Book tells how to design for investment casting and gives data on metal properties.
13. **Die Casting Machines**—B&T Machinery Co.—Information on a motorized die height adjustment on die casting machines.
14. **Die Casting Machines**—DCMT Sales Corp., Div. of British Industries Corp.—Literature on DCMT Mac 99 and the Ram die casting machines.
15. **Metals and Alloys**—Cannon-Muskegon Corp.—Information on a new X-ray method for analyzing metals and alloys.
16. **Refractories**—The Carborundum Co., General Refractories—Information on a ceramic that can be used like a metal under conditions that metal parts can't take.
21. **Abrasives**—Cratex Mfg. Co., Inc.—Catalog on a line of rubberized abrasives for deburring, smoothing and cleaning.
22. **Tool Steels**—Crucible Steel Co. of America—Information on high-hardness CSM-2 and NU-DIE mold and die steels.
23. **Standard Unit Dies**—Detroit Mold Engineering Co.—Technical brochure tells how to get lower costs through standardization.
26. **Die Casting**—Dollin Corp.—Brochure describes die casting equipment and services.
29. **Lubricants**—Grafo Colloids Corp.—Booklet describes a complete line of colloidal dispersions for extruding or die casting.
30. **Tiny Zinc Die Castings**—Gries Reproducer Corp.—Booklet includes designer's check list for small zinc die castings.

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

6. **Refractories and Crucibles**—American Refractories & Crucible Corp.—Technical assistance offered in the use and installation of crucibles and refractory materials.
17. **Investment Casting Equipment**—Casting Supply House—Literature describes investment casting equipment and application.
27. **Parting Agents**—Dow Corning Corp.—Manual describes how to use silicone parting agents in shell molding.
28. **Tools and Dies**—The Efficient Tool & Die Co.—Brochure describes equipment and services for making die casting dies, trim dies, and permanent molds.
31. **Metal Powders**—United International Research, Inc.—Offers pure, air-stable titanium metal powders.
66. **Investments**—The Ransom & Randolph Co.—Offer services to provide investments for casting low and high melting alloys.
73. **Barrel Finishing**—The Carborundum Co., Elec. Min. Div.—Offer barrel finishing services for grinding, polishing and buffing parts.
74. **Investment**—Pre-Vest, Inc.—Technical information and a free sample of P-V investments for investment casting.
76. **Investment Casting**—Harcast Co., Inc.—Offer complete services and wide alloy selection for producing investment castings.
77. **Investment Casting**—Rode, Inc.—Offer services for producing waveguide investment castings.
78. **Wax Shapes**—Yates Mfg. Co.—Technical literature describes a complete line of wax shapes for investment casting.
81. **Investment Casting**—Precision Founders, Inc.—Investment casting services include use of preformed ceramic cores.
87. **Ceramic Cores**—Sherwood Refractories—Technical design data describes how to use ceramic preformed cores in investment casting.
92. **Tools and Dies**—Diecraft Tool Co.—Offer services for tooling for powder metallurgy.

32. **Fluxes**—Haviland Products Co.—Brochure on zinc and aluminum fluxes.
33. **Atmosphere Generators**—Bulletins describe a complete line of protective atmosphere equipment.
34. **Investment Casting**—Hitchiner Mfg. Co.—Technical information on the investment casting process it uses to provide designers more freedom of design, shape and materials.
35. **Powdered Metals**—Hoeganaes Sponge Iron Corp.—Booklet gives data on pre-alloyed stainless steel and other high alloy powders.
37. **Die Casting Machines**—H-P-M Div., Koehring Co.—Data on a Lab Test Program for testing Cast-Master die casting machines.
40. **Die Casting Machines**—Kux Machine Co.—Catalog describes an entire line of die casting machines.
42. **Heating Equipment**—Lepel High Frequency Labs, Inc.—Catalog on a complete line of induction heating equipment.
43. **Die Casting Machines**—Lester-Phoenix, Inc.—Bulletin tells how the Certified Clamp helps you die cast quality parts.
45. **Investment Casting**—Midwest Precision Castings Co.—Brochure describes how to design for investment casting.
47. **Investment Casting**—Misco Precision Casting Co.—Information on the Mono-Shell process for investment casting aluminum.
48. **Metals and Alloys**—The New Jersey Zinc Co.—Technical data books describe use of Zamak alloys in die casting.

more Data on next page

To avoid copper and brass cleaning problems

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

Electroclean copper and its alloys with speed—without tarnish

Oakite 191 gives fast, thorough action in electrocleaning brass and other copper alloys . . . simultaneously protecting against tarnish especially in reverse current tanks. Speeds removal of shop soils, smuts, light buffing compounds . . . provides an effective, non-tarnishing pre-soak for heavily contaminated parts.

But that's not all! It tolerates chromic acid drag-in . . . has high conductivity for efficient use of power . . . works well in hard water . . . rinses freely . . . has long life . . . no objectionable odor . . . won't form precipitate or water-break marks on the work.

Oakite 191 is one of a complete line of materials for cleaning any metal—even the problem ones. Ask the Oakite man. Or send for Bulletin F-9355. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

Circle No. **50** on Reader Service Card

data in ads

49. Non-Ferrous Powdered Metals—The New Jersey Zinc Co.—Brochure tells how to design for pressed brass and nickel silver parts.

50. Cleaning Agent—Oakite Products, Inc.—Bulletin describes a complete line of materials for cleaning and protecting metals.

52. Lubricating Equipment—Pierce-Waller, Inc.—Information on a system for lubricating, cleaning and cooling molds.

53. Powder Metallurgy—Reese Metal Products Corp.—Booklet tells how to cut costs by the Remet process.

55. Investment Casting Furnaces—Alex. Saunders & Co., Inc.—Information on a line of shell investment mold furnaces.

56. High-Purity Nickel—Sherritt-Gordon Mines Ltd.—Brochure on high purity nickel.

58. Compacting Press—F. J. Stokes Corp.—Bulletin describes a 50-ton, multiple motion, powder metal press.

60. Pots—The Tiffin Foundry Inc.—Brochure lists a complete line of stock pots and die casting machine accessories.

62. Palletainers—Union Steel Products Co.—Information on Palletainers used to ease parts handling problems.

64. Temperature Controls—West Instrument Corp.—Bulletin describes digital set point controllers for heating equipment.

68. Crucibles—Denver Fire Clay Co.—Catalog gives full information on a line of crucibles and funnels.

69. Induction Furnaces—Brown Boveri Corp.—Technical information on a coreless line-frequency induction furnace.

70. Barrel Finishing Machines—Almco Queen Products Div.—Catalog lists a complete line of barrel finishing machines, media and compounds.

72. Powder Metallurgy—American Sinterings Div.—Brochure describes equipment and services for producing powder metal parts.

75. Investment Casting—Casting Engineers—Technical brochure describes how to design for investment casting.

79. Investment Casting—Atlantic Casting & Engineering Corp.—Information available on casting a full range of non-ferrous alloys.

84. Powder Metallurgy—Asco Sintering Corp.—Brochure describes how to cut parts costs by designing for powder metallurgy.

90. Investment Casting—Filtros Inc.—Brochure describes a porous ceramic plate for coating investment and shell mold patterns.

LEVELMAX BRIGHT NICKEL

BRIGHT, HARD, SMOOTH FINISHES

on rough, dull, unbuffed surfaces

Levelmax — the bright nickel process — reduces or eliminates surface buffing and polishing, simplifies chrome plating, makes possible bright plating of hard-to-buff areas. You get bright, smooth nickel coatings on poorly polished steel, unbuffed stampings and castings and dull copper plate. Levelmax is simple to control, has high tolerance to organic and metallic contamination, can be used under standard plating conditions. Levelling action is excellent. Levelmax bright nickel takes chrome easily. The Levelmax process is the most versatile of the nickel processes for varied product shapes, base metals and applications.

For complete working details, write on your company letterhead for Bulletin 191, Levelmax operating manual. Write Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y., or call your nearest Federated sales office.

ASARCO

EXHIBITORS' LITERATURE FROM THE 1961

For those who missed the Metal Powder Industries Federation show in Cleveland last April, here's a list of exhibitors' literature which was available. *Use the reader service card facing page 52 for copies of literature which interest you.*

---

301. Product Design—New Jersey Zinc Co.—24-page booklet—shows how to design pressed brass and nickel silver metal powder parts. Shows powder properties, applications, and proper part configurations.

302. Powder Properties — American Sinterings Div. — Technical data sheet — lists the mechanical properties and applications for various powder blends.

303. Tooling—Cleveland Tool and Die Co. — Facilities booklet — lists equipment and services available for building dies, jigs, fixtures, and gages.

304. Sealing—National Sinter-Seal Co. — 8-page technical booklet — describes a process for sealing the porous structure of powdered metal parts.

305. Sintering Furnace — Harper Electric Furnace Corp.—Data sheet—describes a controlled atmosphere, box-type sintering furnace for sintering, impregnating, and infiltrating powdered metal parts.

306. Production Equipment — Mettler Instrument Corp. — 3-page brochure—lists the features and applications for checkweighing, sorting, statistical tabulation, and machine control equipment used in the production of powdered metal parts.

307. Compacting Press — Baldwin-Lima-Hamilton Corp. — 4-page technical bulletin — describes a compacting press which allows adjustment of part density or weight while the press is in operation.

308. Sintering Furnaces—Drever Co.—12-page brochure — describes a line of batch-type, pusher-type, controlled atmosphere, conveyor belt, and roller hearth sintering furnaces.

309. Impact Testing—A. Johnson & Co., Inc.—5-page technical report—discusses the impact testing of powdered metal parts, tells how to get better resistance to impact loads.

310. Powdered Metal Parts—Powdercraft Corp. — 6-page brochure — discusses the application and properties of powdered metal parts, lists specifications for standard self-lubricating bearings.

311. Iron Powder — Alan Wood Steel Co.—Technical data bulletin—lists the mechanical properties, screen analysis, and chemical analysis of various grades of iron powder.

312. Sintering Furnaces — Lindberg Engineering Co.—8-page bulletin describes a line of atmosphere generators and pusher-type, continuous belt, and roller hearth sintering furnaces.

313. Metal Powder — Charles Hardy, Inc.—Data sheet—lists the green and sintered properties of a nickel-iron prealloyed metal powder.

314. Product Design — Dixon Sintaloy Inc.— 12-page booklet — discusses the principles of economical design and production of powdered metal parts, lists the typical characteristics of various powders.

315. Coining Presses—A. C. Compacting Presses Inc.—Data sheet lists the specifications and features of high-efficiency automatic coining and sizing presses.

"IF YOU'RE MELTING ALUMINUM OR ZINC—

I'LL SHOW YOU HOW TO SAVE UP TO 50% ON FLUX!"

That's right. Haviland's 4-B for Aluminum or 3-G for Zinc can save you up to 50% on Flux costs. How? By separating four times more metal from dross with Haviland fluxes. Many of our customers have found Haviland-separated dross is so low in metal content that pulverizing or mechanical seperation is unnecessary . . . and they're getting better alloys, too. Haviland Flux is: FAST — even at lower furnace temperatures where other fluxes might fail. SAFE — less dangerous acrid or stinging fumes.

USE HAVILAND 4-B ALUMINUM FLUX

- Greater metal-dross separation
- Works at lower temperature (1250° F)
- Essentially smokeless
- Pulverizing or mechanical separation unnecessary
- Safe in any type of furnace

USE HAVILAND 3-G ZINC FLUX

- Complete metal-dross separation
- Economical — less flux required
- Safe in any type of furnace
- Essentially smokeless

Write for complete information and fluxing procedures.

Haviland PRODUCTS COMPANY

421 Ann Street, N.W. Grand Rapids, Michigan

Circle No. 32 on Reader Service Card

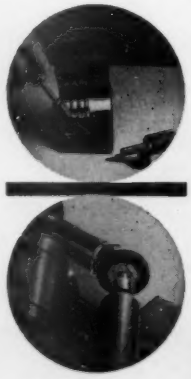
CRATEX RUBBERIZED ABRASIVES

re·li'a·ble: That which can always be counted upon to do what is expected or required

Micro-deburring, Smoothing, Cleaning, Polishing

Cratex reliability lowers costs

You can count on every Cratex item to perform just as you expect it to—exactly as the last one did and as the next one will. This is the key to efficiency in micro-deburring, smoothing, cleaning and polishing. YOU SAVE TIME because you know just what to expect in performance without experimenting or compensating. YOU SAVE REJECTS because with Cratex no unexpected irregularities occur to spoil work pieces.



WHEELS • POINTS • BLOCKS • STICKS • CONES in 4 grit textures for power or manual application. Sold through leading industrial supply distributors.

FREE! *Send for the complete CRATEX Industrial Catalog today*

CRATEX MANUFACTURING COMPANY, INC.

1600 Rollins Road Burlingame, California

Circle No. 21 on Reader Service Card

M.P.I.F. SHOW

316. **Product Design** — American Powdered Metals, Inc. — 8-page technical booklet — shows preferred design features and lists the mechanical properties of powdered metal parts.

317. **Compacting Presses** — F. J. Stokes Corp. — Technical brochure — lists complete specifications on single punch and rotary compacting presses.

318. **Metal Powders** — Federal-Mogul Div.—Brochure—describes manufacturing methods and applications for pre-alloyed and elemental atomized metal powders.

319. **Compacting Press**—Kux Machine Co. — 4-page brochure — lists the features and specifications for a completely automatic 125-ton compacting press.

320. **Metal Powders** — Hoeganaes Sponge Iron Corp. — Brochure — lists technical data on pre-alloyed stainless steel and high alloy powders.

321. **Compacting Press**—Mannesmann-Meer, Inc.—4-page bulletin—describes Bussmann-Simetag compacting presses available in 60 to 200 ton capacities.

Circle No. 84 on Reader Service Card

Powdered Metal Parts

ASCO powdered metal parts offer many proven advantages. First, economy, **with savings up to 40%.** Second, dimensional control superior to cast parts. Third, elimination of many secondary machine operations. Fourth, improved function with self lubrication. Fifth, the ability to combine metallic and non-metallic elements. These unique advantages are yours only in powdered metal... why not call or write Asco today for full information.

Self Lubricating Bearings... *Asco has in stock over 3000 bearings in standard sizes. This means big savings in tooling costs to you. Special sizes are available on short notice.*

ASCO
SINTERING CORPORATION

FREE BROCHURE
Get all the facts on the money-saving advantages of powder metallurgy in Asco's new brochure.

7799 TELEGRAPH ROAD
LOS ANGELES 22 · CALIF.
(Santa Ana Freeway at Slauson)

for information call – RAymond 3-5121

STILL THE PRIME SOURCE OF PURE, AIR-STABLE
TITANIUM METAL POWDER

for powder metallurgy, titanizing, alloying, rocket propellants pyrotechnics, etc.

United International Research, Inc.
38-15 30th Street
Long Island City, New York

Circle No. 31 on Reader Service Card

another unique **GRC die cast** zinc alloy component

this movable Intercast® element unit was
cast-assembled in one operation
by GRC

GRC's unique patented INTERCAST method die casts multiple-part zinc-alloy units with moving elements in a single, automatic, time saving, money-saving operation . . . even continuously interlocked assemblies. Units leave the machine complete . . . no trimming, no assembly, no machining needed. This INTERCAST technique is an ingenious refinement of GRC's exclusive method of small parts die casting—providing broad design latitude, close tolerances, economies in quantities of 100,000 and more.

Let GRC solve your problems. No size too small. Maximum length 2", maximum weight: ½ oz. ***Send TODAY for samples, prices and fact-filled bulletin.***

World's Foremost Producer of Small Die Castings

GRIES

GRIES REPRODUCER CORP.
157 Beechwood Ave., New Rochelle, New York • NEw Rochelle 3-8600

Circle No. 30 on Reader Service Card

The Abbot asks you: What's right for your product...
FINISH
...or CUT?

WHEN METAL PRODUCTS or parts need a polished, mirror-like, glass-hard *finish*, steel burnishing should be used... not synthetic abrasives, which have comparative application superiority only when *cutting* is what's wanted.

The high-quality steel shapes shown above on the top are products of the Abbott Ball Company, since 1909 the world's leading producer of steel finishing materials. Each different shape is designed for a special job.

SEND A SAMPLE of your product or part to us. Without charge, we'll conduct a thorough test and analysis on it, and return useful recommendations to you promptly.

Examining some samples after their test-run in the Abbott lab.

Write for copy of Bulletin AP-1

ABBOT the Leader since 1909

THE ABBOTT BALL COMPANY
7 RAILROAD AVE. • HARTFORD 10, CONN.

Circle No. 1 on Reader Service Card

AN INDUSTRY RESEARCHES FOR A BETTER PRODUCT

NEW TECHNOLOGY, ideas and applications are some of the benefits members of the Investment Casting Institute receive through organized research initiated and sponsored by the Institute.

Two men supervise the program; Dr. Jack Keverian, I.C.I.'s research program chairman, and C. A. Crawford, I.C.I.'s technical director. They work in close cooperation with the members and five committees to set up a total research program. After consulation, projects are outlined, defined, then assigned or divided among the membership. When the research is completed and a report made, it is distributed to the entire membership.

Related industries are joining. Active participation by affiliated members include manufacturers of metals, investment materials, waxes and equipment to produce investment castings.

KEVERIAN

CRAWFORD

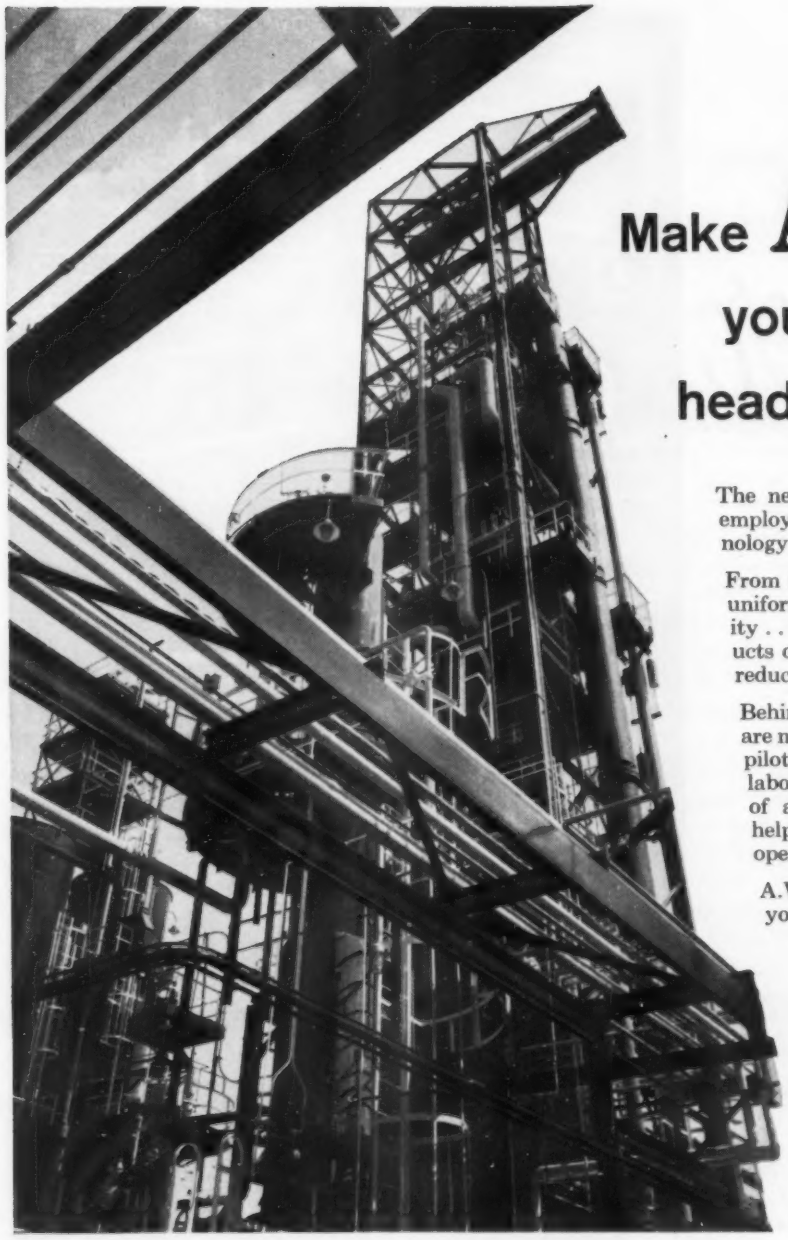
Chairman of I.C.I.'s research program is DR. JACK KEVERIAN, manager of the Foundry Department, Research and Development Lab., General Electric Company. C. A. CRAWFORD is technical director of the I.C.I.

The success of the program can be seen by the reports already presented and the growth in quantity of projects undertaken. Four completed reports include: "The Effect of Aging Time and Temperature on the Mechanical Properties of Investment Cast 17-4PH", "Particle Coating in Investment Casting Mold Manufacture Using Solid Fluidization", "Heat Treatment and Properties of Cast Hardenable Stainless Steel", and "Nondestructive Methods for Measuring the Dryness of Dip Coating".

New projects in various stages of operation are being directed by five committees: (1) Cast Structures & Properties, F. K. Iverson, chairman; (2) Casting & Solidification, H. Rosenthal, chairman; (3) Melting Practice, G. J. Grott, chairman (succeeding W. P. James); (4) Investment and Pattern Materials, F. C. Quigley, chairman; and (5) Testing and Inspection, E. M. Broad, chairman.

Current projects being studied include: "Study of Variables Affecting Tensile Properties in Investment Cast High Purity 356 Aluminum", "Impact Properties of Investment Casting Alloy Steels", "Feeding Distance of Investment Cast Steel Bars", Methods and Techniques of Temperature Measurement", "Effects of Heat Treatment on Properties of 17-4PH and AM-355 Alloys", "Variations in Mechanical Properties of 4340 Steel as Affected by Composition", "Dimensional Variations in Wax Patterns", "Austenitic Grain Size Standards", "Standardization of Defect Terminology", "Radiographs for Thin Wall Steel Castings", "Methods of Chemical Certification".

For more information on this program or membership in I.C.I., contact H. P. Dolan, Executive Director, Investment Casting Institute, 27 East Monroe Street, Chicago 3, Illinois.



Make A.W. your iron powder headquarters

The new Alan Wood direct reduction plant employs the industry's most advanced technology.

From it comes Iron Powder with purity and uniformity that offers you new design flexibility . . . new fabricating possibilities . . . products of superior quality, closer tolerances at reduced production costs.

Behind this modern fifty-ton-a-day facility are many years of metallurgical research and pilot plant operation. Within its complete laboratory facilities, a continuing program of application investigation and analysis helps customers improve their production operations.

A.W. Iron Powder can be *custom blended* to your most exacting specifications.

Make Alan Wood your Iron Powder Headquarters. You'll like the prompt deliveries and the helpful Customer Advisory Service.

ALAN WOOD STEEL COMPANY

CONSHOHOCKEN, PA.

FOR MORE INFORMATION

IRON POWDER DIVISION
ALAN WOOD STEEL COMPANY
Conshohocken, Pa.

I am interested in Iron Powder for:
☐ Molding ☐ Friction ☐ Other
☐ Send literature ☐ Send sample

NAME _____
TITLE _____
COMPANY _____
ADDRESS _____ CITY _____ STATE _____

AMERICAN STEELMASTERS FOR 135 YEARS

Circle No. 3 on Reader Service Card

LET

Superior

DEVELOP YOUR ALUMINUM "TRIM IDEAS"

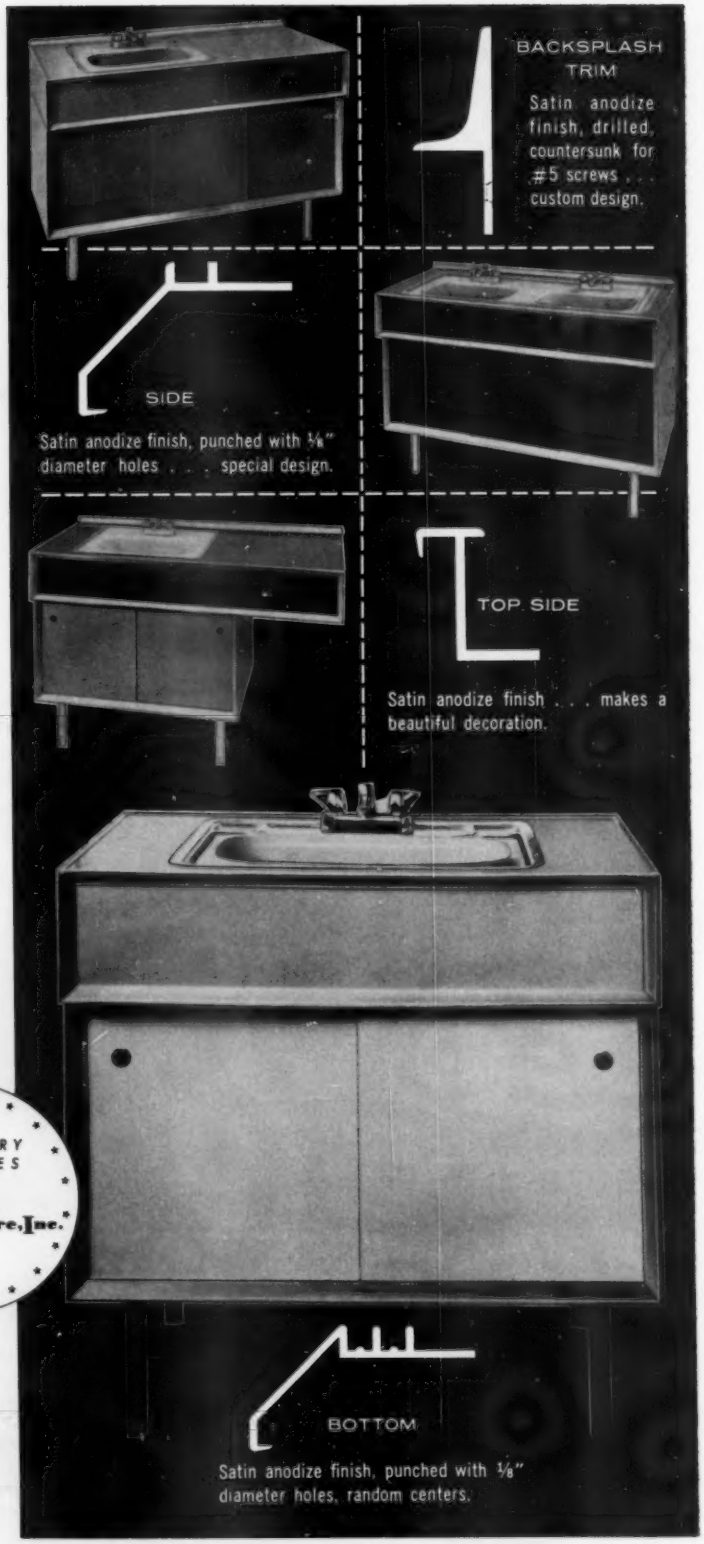
Here's how one company used Superior Industries' engineering services and production facilities in planning its metal trim requirements for a new product.

. . . and it wound up with beautiful, special designs to match functional and decorative requirements of an exquisite AllianceWare lavatory vanity.

Peter Muller-Munk Associates designed the AllianceWare vanity and also the aluminum trim. Superior was called upon to meet the specifications and match uncompromising mechanical accuracy and finish.

Under one roof, Superior miters, bends, rivets, drills, countersinks and notches the metal. Chemical and hand polishing, spray painting, and anodizing get professional attention.

Thousands of companies have used Superior's facilities. So give it a try . . . send samples, blueprints or ask us to call.


BACKSPLASH TRIM
Satin anodize finish, drilled, countersunk for #5 screws . . . custom design.
SIDE
Satin anodize finish, punched with ⅛" diameter holes . . . special design.
TOP SIDE
Satin anodize finish . . . makes a beautiful decoration.
LAVATORY VANITIES BY AllianceWare, Inc.
BOTTOM
Satin anodize finish, punched with ⅛" diameter holes, random centers.

ALUMINUM EXTRUDERS • ANODIZERS • ARTRIM MOULDINGS

SUPERIOR INDUSTRIES INC.

3788 OAKWOOD AVENUE • YOUNGSTOWN, OHIO

Circle No. 59 on Reader Service Card

PMM

useful literature, catalogs, manuals *qualified readers may obtain*

any of these technical publications by circling the numbers on the reader service cards.

PROCESSES

• ***Die Casting***—THE SOCIETY OF DIE CASTING ENGINEERS, INC.—Bound volumes of the 1960 Die Casting Congress technical papers are for sale at $10 a copy. Write to the Society at 19382 James Couzens Highway, Detroit 35, Michigan.

150 ***Die Casting***—RAY LEWIS & SON, INC.—Bulletin describes zinc die cast parts for the tubular and plumbing industry.

151 ***Investment Casting***—REX PRECISION PRODUCTS, INC.—Brochure gives technical data on investment castings.

152 ***Die Casting***—TWIN CITY DIE CASTINGS CO.—Brochure for design, engineering and purchasing personnel describes services and facilities.

153 ***Investment Casting***—HITCHINER MANUFACTURING CO., INC.—Bulletin describes how investment casting solves design problems.

154 ***Die Casting***—THE TOOL-DIE ENGINEERING CO., INC.—Technical brochure lists composition and properties for die casting zinc and aluminum alloys.

MATERIALS & EQUIPMENT

155 ***Lubricant***—BEMOL INC.—Report of specifications and applications of a water soluble moly lubricant, die casting and extrusion.

156 ***Heat Treating Equipment***—FAHRALLOY CO.—Brochure on shell mold conveyor belts for heat treating equipment shows results of unbalanced design.

157 ***Ring Sprockets***—AMERICAN-MARIETTA CO.—Technical brochure describes full line of ring sprockets for rotary dryers, continuous furnaces, tilting furnaces and rotary drums.

158 ***Die Casting Machine Accessories***—SETHCO MFG. CORP.—Bulletin on miniature unit for filtering small volumes of corrosive chemicals from hydraulic fluids.

159 ***Counting Instruments***—AUTOMATION CONTROLS DIV.—6-page Folder describes a line of counting instruments—electric, stroke, turn, and includes counter actuators.

160 ***Testing Instruments***—BRANSON INSTRUMENTS, INC.—Technical bulletins describe a flaw detector and two thickness testers for castings.

161 ***Extrusion Equipment***—DEBOTHEZAT FANS—12-page Technical brochure describes air quenching of aluminum extrusions.

162 ***Preformed Cores***—SHERWOOD REFRACTORIES—4-page Brochure describes facilities and services for making preformed ceramic cores for investment casting.

163 ***Die Casting Machine Accessories***—ULLMAN DEVICES CORP.—12-page Brochure describes ratchet piston ring compressors and Fire-Spy, a thermal warning device.

164 ***Die Casting Dies***—ZAPF & COMPANY—Brochure describes facilities and equipment for making die casting dies.

165 ***Heating Equipment***—LEPEL HIGH FREQUENCY LABORATORIES, INC.—Catalog on a complete line of high-frequency induction heating equipment.

166 ***Titanium***—TITANIUM METALS CORP. OF AMERICA—14-page Study summarizes six major application areas for titanium in missile construction.

167 ***Power Cylinders***—HANNIFIN COMPANY—Reference bulletin provides quick identification of mounting accessories for square-type, industrial hydraulic and pneumatic power cylinders.

168 ***Patterns and Binders***—KOPPERS CO., INC.—Technical bulletin describes patterns for investment casting and binders for powder metallurgy.

169 ***Powder Metals***—HOEGANAES SPONGE IRON CORP.—Brochure gives technical data on pre-alloyed stainless steel and high alloy powders.

170 ***Steel Price Estimator***—LATROBE STEEL COMPANY—Slide-rule price estimator and weight calculator for tool, die and specialty steels, is used by tooling engineers, toolmakers and purchasing agents.

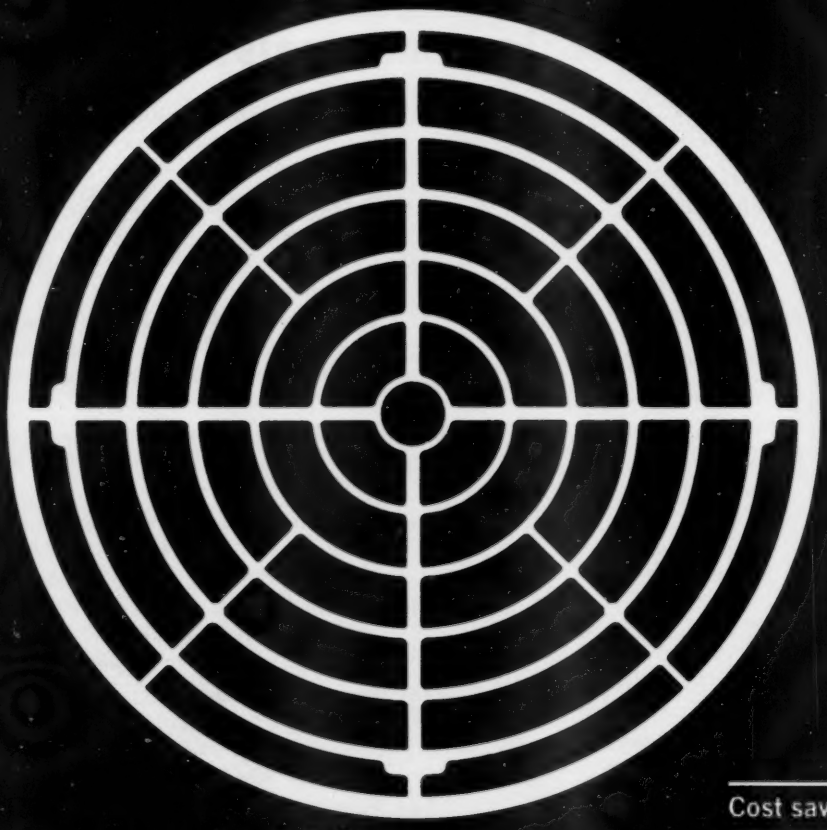
FINISHING

175 ***Inserts and Studs***—NEWTON INSERT CO.—28-page Catalog has technical data on twenty different series of threaded inserts and studs.

176 ***Drill Presses***—THE ELECTRO-MECHANO CO.—Bulletin describes a line of high-speed precision drill presses.

177 ***Decorative Finishes***—RED SPOT PAINT & VARNISH CO., INC.—Catalog and loose-leaf sheets describe coatings and colors for vacuum metalizing and decorating of metals.

more Useful Literature on page 63



Cost saving: 33%

"are you getting your metal's worth?"

The intake tubes of the Waterous Company's model CMB fire pump suck in 1250 gallons of water a minute. Rocks and other foreign matter can get sucked in too—which would have disastrous effects on the pump. A screen is needed on the intake tubes, a screen that's tough and corrosion resistant, with extra-thin vanes and a smooth surface for unimpeded water flow.

Originally these screens were fabricated from sheet brass, with the vanes brazed together. An expensive material and method for a simple but important component. **Today these screens are die cast of Zamak at a cost saving of 33%** by Twin City Die Casting of Minneapolis. The tapered vanes have a minimum wall thickness of 1/32 of an inch. Zamak is the only die casting material that can fill these thin sections and still provide the strength, corrosion resistance and smooth "as cast" surface necessary.

To find out how you can put zinc die casting to work cutting your production costs, write today to The New Jersey Zinc Company for your set of Zamak technical data books detailing the properties, use, design techniques and machining practices of the Zamak alloys. Remember—Zamak gives you more for less. Are you getting your metal's worth?

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

HORSE HEAD PRODUCTS

useful literature, catalogs, manuals

178 *Drill Press*—WALKER-TURNER DIV.—Information on a new 17" drill press line with depth stops which eliminate quill, spindle and cutting tool deflection.

179 *Drilling & Grinding*—FOOTE-BURT CO.—6-page Catalog describes a line of drilling machines and surface grinders.

180 *Drilling & Tapping*—BECKETT-HARCUM CO.—8-page Brochure gives detailed specifications on a line of drill press feeds and drilling and tapping machines.

181 *Drilling Machine*—PRATT & WHITNEY CO., INC.—4-page Brochure describes a machine for critical drilling production.

182 *Vibratory Tumblers*—UNIVERSAL VIBRATING SCREEN CO.—Data sheet on a line of vibratory tumbling machines.

183 *Buffing and Polishing*—ACME MANUFACTURING CO.—20-page Catalog describes a complete line of semi-automatic machines for low production deburring, buffing and polishing operations.

184 *Abrasive Finishing Equipment*—THE CARBORUNDUM CO.—6-page Folder gives data on contact wheels and rolls for abrasive belt set-ups.

185 *Electroplating*—HANSON-VAN WINKLE-MUNNING CO.—24-page Bulletin describes nineteen plating and other metal finishing processes and procedures.

186 *Nickel Stripper*—ENTHONE, INC.—Bulletin describes solutions that strip nickel from metals by simple immersion.

187 *Brightener*—CONVERSION CHEMICAL CORP.—Fact sheet gives data on a solution for brightening and corrosion protection of cadmium plate.

188 *Plating Protection*—BEE CHEMICAL CO.—Brochure describes a non-flammable solution used to protect plated parts against corrosion, staining and handling.

189 *Polishing Wheels*—DIVINE BROTHERS CO.—4-page Condensed catalog describes a line of cloth polishing wheels.

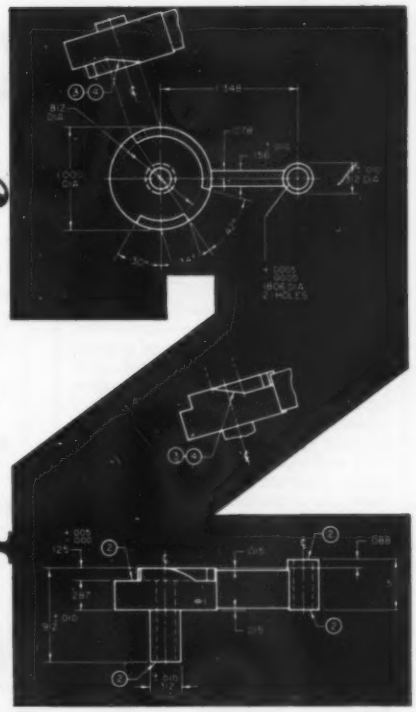
190 *Inserts*—HELI-COIL CORP.—Bulletin gives technical data on drilling and tapping aluminum, magnesium, and steel for a line of inserts.

191 *Belt Finishing*—THE CARBORUNDUM CO.—Brochure describes wide belt usage in finishing metal.

192 *Finish Drying*—PHILLIPS MANUFACTURING CO.—Bulletin describes a drying solvent used to give castings a spot-free finish.

193 *Magnetic Testing*—MAGNAFLUX CORP.—Literature describes a concentrate in powder form for magnetic particle testing. Magnetic test baths are prepared with ease. Florescences is from 70% to 600% greater. The powders are easy mixing, handling and easy to store.

blueprint for



The blueprint shown above is for a phonograph motor toggle link pressed from brass powder by American Powdered Metals Inc. for the General Industries Company. Why blueprint for two? Because it combines 2 design functions—structural support and cam surface—in a single part. Because powder metallurgy is the only economically practical way to make this part—and it could not have been achieved without design teamwork between the customer and the metal powder fabricator.

Teamwork produced a precise, intricate part assuring exact turntable speed and providing a cam surface which controls speed selection. The cam surface must be smooth and accurate—and stay that way. Holes must parallel and round to within .0005" total indicator reading. Hole centerlines must be parallel to each other within .002" T.I.R. Brass powder supplies the properties necessary for these requirements with its ideal combination of structural strength and self-lubrication.

Working together, the metal powder fabricator and design engineer make economical mass production of critical parts a reality. And we also mean "critical" in the sense that a whole is no better than the quality of its most prosaic part. For more information about the design, application and advantages of nonferrous metal powder parts, write today to The New Jersey Zinc Company for your copy of "Designing For Pressed Brass and Nickel Silver Parts."

HORSE HEAD® ATOMIZED NONFERROUS METAL POWDERS ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF BRASS & NICKEL SILVER POWDERS SETTING TODAY'S STANDARDS

HORSE HEAD PRODUCTS

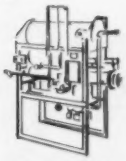
Circle No. 49 on Reader Service Card

←Circle 48

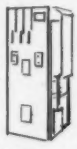
WILLIAM C. DIMAN,
Atmosphere Equipment Specialist, reports . . .

MODERN METALS DEMAND MODERN ATMOSPHERES

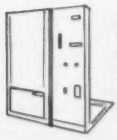
Ever since 1927, when Hayes perfected the first controlled-atmosphere furnace, we have made a steady effort to further the technology of protective atmosphere heat treating. By recommending proper atmosphere equipment, we have helped customers increase production, obtain uniform product quality, and save processing time and trouble. Today, our atmosphere generator line, probably the most comprehensive in the business, includes:



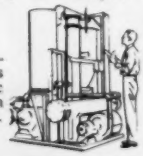
Exothermic Generators . . . for oxidizing or medium-reducing type atmospheres. Standard sizes from 200 CFH to 50,000 CFH.



Endothermic Generators — for reducing and carbon potential atmospheres. Standard sizes from 100 CFH to 20,000 CFH.

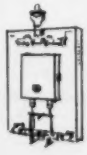


Ammonia Dissociators — for producing hydrogen-nitrogen atmospheres of high purity and low dew point. Standard sizes to 5,000 CFH, or multiples thereof.



Nitrogen Generators — for 99.99% pure inert gas at less than 20¢ per cubic foot. Standard sizes from 1,000 CFH to 10,000 CFH.

Forming Gas Generators — for producing controlled ratios of nitrogen and hydrogen from dissociated ammonia. Standard sizes 500 CFH, 1,000 CFH, and larger upon request.



Molecu-Dryer (with LINDE'S Molecular Sieves) — for drying, sweetening, purifying protective atmospheres down to dew points of minus 100° F. Standard sizes from 250 CFH to 6,000 CFH and larger on request.

Hayes offers more than just equipment. Our engineering organization and experimental lab are ready to help make sure you get a "Results Guaranteed" solution to your heat treating or protective atmosphere problem. Write for descriptive bulletins.

C. I. HAYES, INC.

Established 1905

819 WELLINGTON AVE. • CRANSTON 10, R. I.

ELECTRIC FURNACES

It pays to see HAYES for metallurgical guidance, laboratory facilities, furnaces, atmosphere generators, gas and fluid dryers.

Circle No. **33** on Reader Service Card

new products & developments

Continued from page 15

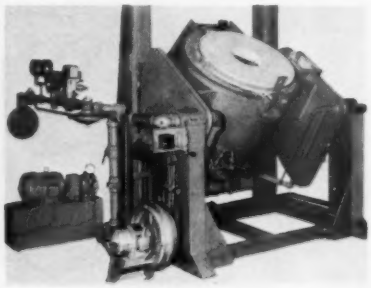
Sintered titanium alloy

CLEVITE CORP.—CPT-64AV sintered titanium alloy has an excellent balance between tensile strength (119,000 psi), ductility (6% elongation), and hardness (Rockwell C 23).

Circle No. **238** on Reader Service Card

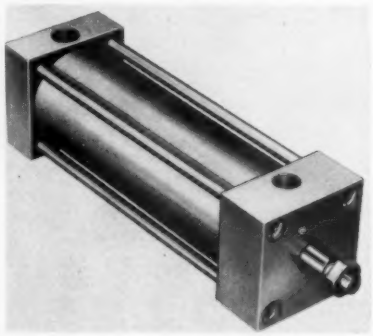
Melting furnace

WARWICK INDUSTRIAL FURNACE & ENGINEERING CORP.—Model WCT-4 nose pour crucible melting furnace gives a fast pour from furnace to ladle. Metal travel is minimized. The stationary lip eliminates need for moving the ladle during pour.



Circle No. **239** on Reader Service Card

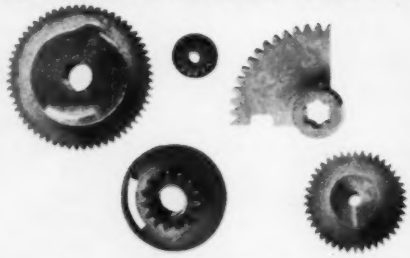
Air power cylinders



HANNIFIN CO.—Series C general purpose air power cylinders have one-piece non-score piston construction. Metal-to-metal contact on cylinder body and stroke ends is eliminated. The 200 p.s.i. maximum air cylinder comes in five sizes.

Circle No. **240** on Reader Service Card

When you want SINTERINGS, call the AWARD WINNER first



Five cam-gear combination metal powder parts designed for production by American Sinterings for use in a fire alarm pull box, were chosen for their:

HIGH DENSITY
HARDNESS
PRODUCTION STABILITY
IMPACT STRENGTH

THESE BRASS POWDER METAL SINTERINGS were chosen the non-ferrous powdered metal Grand Prize winners in the 1961 New Jersey Zinc Co. contest. The know-how used by American Sinterings to make them, is applied to all its parts.

PM PM MEMBER

SEND FOR THIS BROCHURE TO FIND HOW WE CAN SERVE YOUR EVERY POWDER METALLURGY NEED.

American Sinterings

A DIVISION OF ENGINEERED PLASTICS, INC.
WATERTOWN, CONNECTICUT

Circle No. **72** on Reader Service Card

news of industry & associations

Continued from page 21

winner was Vladi S. Malakhof, a junior in mechanical engineering at the University of Missouri.

The award was presented to the chairman of the awards committee, Lewis W. Davis of Metal Hydrides, Inc., by David W. Veit, publishing director of PRECISION METAL MOLDING.

New Jersey Zinc Co. contest winners

The New Jersey Zinc Co. "Non-ferrous Metal Powder Part of the Year" competition winners for 1961 were Walter F. Schuchard, chief engineer of the S. H. Couch Co. and Alexander L. Alves, president of Engineered Plastics, Inc. A detailed report is given on pages 42 & 43 of this issue.

Receiving Award of Distinction certificates were John Mikitka of Kwikset Powdered Metal Products and Howard Hayden of AiResearch Manufacturing Co. Those deserving Awards of Merit for other than the above entries were: Howard Needham of North American Aviation and John Mikitka of Kwikset Powdered Metal Products; P. F. Hohmann of Microdot Inc. and Donald M. Paullin of Pacific Sintered Metals Co.; P. K. Tracy, L. N. Hatch, and N. S. Graves of The Foxboro Co. and A. L. Alves of Engineered Plastics, Inc.; Wesley Moline of Barber-Colman Co. and J. M. Hildabolt of Metal Powder Products Inc.; W. Naughton and B. Heindricks of Robert Mfg. Corp. and John Mikitka of Kwikset Powdered Metal Products; Paul Barth and Tom Kearns of Mueller Brass Co.; Robert E. Peterson of Union Brass & Metal Mfg. Co. and Philip V. Tarr of Midwest Sintered Products Corp.; and Lawrence R. Burk of General Meters Inc. and R. A. Bagby of Ferro Powdered Metals.

more Industry News on next page

PRECISION BUILT TOOLS
PRODUCE
"PRIZE WINNING PARTS"
For American Sinterings, Watertown, Conn.

Diecraft tools produced these parts that won the Grand Prize in the New Jersey Zinc Company's "Non-ferrous Metal Powder Part of the Year" competition for 1961.
Our modern air-conditioned plant is equipped with the latest, most modern and precise equipment available for close tolerance tooling.

YOU MAKE THE PARTS
WE MAKE THE TOOLS
SEND YOUR PRINTS FOR PROMPT QUOTATION
DIECRAFT TOOL COMPANY
1275 THOMASTON AVE. • WATERBURY 14, CONN.
PLAZA 5-8630

Circle No. 92 on Reader Service Card

"TIFFIN POTS LAST LONGER"

This is a report that we continue to receive from our customers.

Standard melting kettles and machine pots direct from stock are available for all non-ferrous metals.

Special pots are made to your specifications.

We also furnish the following parts in Tiffin alloyd iron or alloyd steel:

- PLUNGERS
- NOZZLES
- GOOSENECK NOSES
- THERMO COUPLES
- INGOT MOLDS
- BAR STOCK

All parts are especially engineered to give the best possible service in the die casting field.

OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

FREE BROCHURE lists stock pots.

Be Thrifty — Be Wise
Use The Best . . .

THE TIFFIN FOUNDRY, INC.
Phone: Gibson 7-3991
TIFFIN, OHIO

Circle No. 60 on Reader Service Card

Circle No. 46 on Reader Service Card

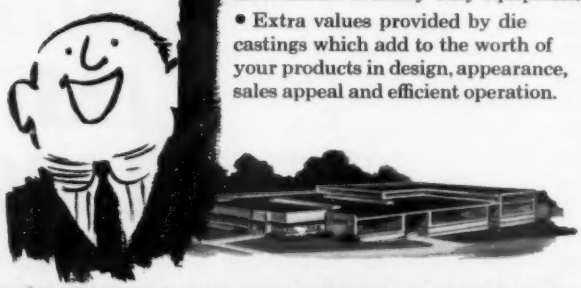
You Get EXTRA VALUES

— when you Specify
DIE CASTINGS
by
MILWAUKEE

• Extra values provided by the modern Milwaukee plant with every facility for Complete Die Casting Service.

• Extra values provided by more than 52 years of continuous service to industry in producing precision die cast parts for all types of assemblies from small intricate instruments to heavy-duty equipment.

• Extra values provided by die castings which add to the worth of your products in design, appearance, sales appeal and efficient operation.



Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

news of industry & associations

Continued

New AZI slate elected

At the May 1 annual meeting of the Board of Directors, F. R. Jeffrey was elected president of the American Zinc Institute. Mr. Jeffrey is president of the National Zinc Co.

Other officers elected were three vice presidents: J. J. Lennon, American Metal Climax, Inc.; C. E. Schwab, The Bunker Hill Co.; and H. L. Young, American Zinc Sales Co. Re-elected were: G. H. LeFevre, U.S. Smelting Refining and Mining Co. as treasurer; and J. L. Kimberley, executive vice president and secretary.

Directors elected by the membership for the term expiring 1964 were: H. D. Carus, Matthiessen & Hegeler Zinc Co.; Francis Cameron, St. Joseph Lead Co.; C. O. Dale, The Eagle-Picher Co.; R. G. Kenly, The New Jersey Zinc Co.; E. H. Klein, The New Jersey Zinc Co.; J. J. Lennon, American Metal Cli-

5th in a series of POWDERED METAL PARTS applications by REESE

Powdered Metals . . .
NEW WAY TO MAKE PADLOCKS

By-passing castings and extrusions, the major parts of this brass padlock for the government are made of Reese powdered metal parts. Higher precision and lower cost result by designing the lock to take full advantage of the powder metal process. All parts meet government specs MIL-B-12128A.

FREE BROCHURE
"How to Cut Precision Parts Costs with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

REESE
METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
Oilless Bearings • Bushings
Machine and Structural Parts in
COPPER • BRASS • IRON
ALLOY STEEL • NICKEL SILVER
COPPER INFILTRATED IRON

Circle No. 53 on Reader Service Card

THIS TRIGGER is your control over mold cavity surfaces - cleans, cools, lubricates in ONE OPERATION

SELF-AGITATING LUBRICANT CONTAINER

Get more *usable* castings with the P-W SYSTEM—universally accepted throughout the die casting industry.

GUN UNITS AVAILABLE SEPARATELY

Write for additional information to
PIERCE-WALLER, INC.
KETTERING P. O. Box 2121
DAYTON 29, OHIO

Circle No. 52 on Reader Service Card

max, Inc.; R. F. Orr, Athletic Mining & Smelting Co.; C. G. Rice, U.S. Smelting Refining & Mining Co.; C. N. Waterman, American Smelting & Refining Co.; and H. L. Young, American Zinc Sales Co.

C. E. Schwab was elected a director to fill a vacancy on the Board of the term expiring 1963.

Die Casting Application Clinic

The Cleveland chapter of The Society of Die Casting Engineers, Inc. held a Die Casting Application Clinic at Hotel Carter, Cleveland on April 19.

About 200 persons interested in die casting were registered and eleven die casters from Ohio and western New York and Pennsylvania had displays of their typical products.

The clinic differed from others which have been held by allowing the vendors who displayed their castings to be identified. As a result, several left the clinic with sets of prints to quote on.

ICI offers technical course

A technical course which will examine melting and solidification behavior in investment casting will be sponsored by the Investment Casting Institute, and conducted in cooperation with Case Institute of Technology on June 20, 21, 1961.

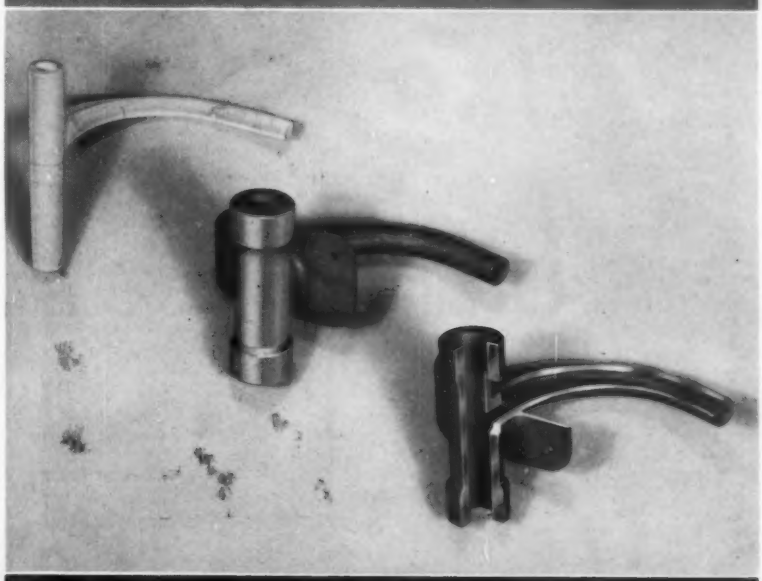
More information is available from the Investment Casting Institute, 27 East Monroe Street, Chicago 3, Illinois.

C-Tron chemical treating

Crown Chemical Metals Corp., a division of Crown Chemical Corp., announced it will market its chemical treating process, "C-Tron".

C-Tron may be applied to a wide range of metals such as aluminum, copper, zinc, lead, tin and magnesium. This process improves the metals working characteristics and physical properties without altering the original analysis. Applied in the molten state, fluidity is greatly increased allowing a lower pour temperature and much less critical attention to mold filling. Castings are sharp and require less "touch-up".

PFI brings new dimensions to investment casting with...



PREFORMED CERAMIC CORES

PRECISION FOUNDERS INCORPORATED
A DIVISION OF THYS COMPANY
414 HESTER STREET, SAN LEANDRO CALIFORNIA

Circle No. 81 on Reader Service Card

SILICONE NEWS from Dow Corning

For Fast Get-away

Silicones Speed Production of Crankshafts for Ford Falcons

"Fast get-away" is an appropriate description for the way foundry shell molds pop free from patterns coated with Dow Corning silicone parting agents. Quick, clean and easy release every time helps assure uninterrupted production, retention of close tolerances, less machining. Here's proof from the Ford Motor Company foundry.

In one production operation, shell molds for casting crankshafts are made on a high production, multi-station rotating machine. Failure of just one shell to separate from its pattern would quickly bring operations to a halt . . . result in waste, rejects and mounting labor and material costs. But not at Ford. Their foundry engineers prescribed the right preventive medicine years ago when they settled on an emulsion of silicone as a shell mold parting agent. All it takes for good results is a light spray coating of the dilute emulsion.

In another shell mold operation Ford dips multi-unit engine valve patterns in the dilute emulsion. Even with such deep draws as are encountered with small diameter valve stems, release is clean and easy . . . production stays on schedule.

If lack of "fast get-away" is hampering your production, why not put Dow Corning Silicones on the job? Send today for a free manual detailing "how to use silicone parting agents in shell molding."

Address Dept. 4518

For complete technical information about any silicone product, contact the Dow Corning office nearest you.

first in silicones

Dow Corning CORPORATION

MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Circle No. **27** on Reader Service Card

CRITERIA FOR USING INVESTMENT CASTINGS

Proper function of a machine or mechanism is the only basic criterion a design engineer may use as the first approach to a problem.

After operational requirements are satisfied, he may consider how and in what metal each part shall be made. Often, at this stage, some concessions must be made because of cost or the difficulty of manufacture.

It is at this stage that the designer should consider the use of investment castings. This method of parts manufacture can give the designer freedom from difficult or impossible machining operations, almost complete metals choice, and does it economically.

Close tolerances and smooth surfaces can be cast in locations where subsequent machining is impossible. Or, conversely where the rigidity of a casting is desirable, but fabricating methods seem to indicate an assembly of parts, then investment casting may be the best and most economical method. The criteria outlined below are based on material from The Investment Casting Institute.

CONFIGURATION

Perhaps the most outstanding advantage of the investment casting process is the flexibility which can be allowed in the shape of parts cast. It is actually hard to imagine a shape which can not be cast by this method.

The illustration (right) shows only a few of the shapes which have been investment cast. Undercuts, blind holes, both open and closed angular passages and many other shapes impossible to machine and which can not be cast accurately enough in sand are made by this process.

The introduction of preformed cores has widened the design latitude even further. Many shape which were very difficult to get are now possible since very accurate, preformed cores are now available. Excellent reproduction of surface detail is another valuable characteristic of investment casting.

Improved waxes, plastics and mold materials have also contributed to this freedom in shape by permitting patterns and molds to be built so that the desired accuracy and detail reproduction are faithfully maintained.

METAL CHOICE

The wide choice of shape in investment casting is paralleled by the wide choice in metals and alloys which can be investment cast. Broadly,

any metal which can be cast by any other process can be investment cast. In addition, there are a number of alloys which are almost specific for this process. While this latter group of materials could, of course, be sand cast, they are largely non-machineable and neither the surface finish nor the dimensional accuracy required can be gotten.

Specifications for many of the metals and alloys have been set up by the Investment Casting Institute. These are the most widely cast materials and include: aluminum base alloys, cobalt base alloys, copper alloys, beryllium copper, low and medium carbon steels, low alloy steels, and series 300 and series 400 stainless steels.

The above are only those materials for which definite specifications have been published. Such alloys as the Stellites, Inco 713, René 41, 17-4PH, magnesium alloys, and many others are widely employed as investment castings.

The designer should remember in connection with metal and alloy choice that, with very few exceptions, he may specify any material available. Either the alloy or an acceptable substitute can be investment cast to his configuration, tolerances, and finish.

TOLERANCES

Probably more misinformation has been written on tolerances in investment casting than on any other subject. While the process is capable of close tolerance work, the popular term "Precision Casting" has led many designers to specify dimensional accuracy possible only by very refined machining. The designer and buyer must recognize that the price of a casting increases rapidly as the tolerances are tightened.

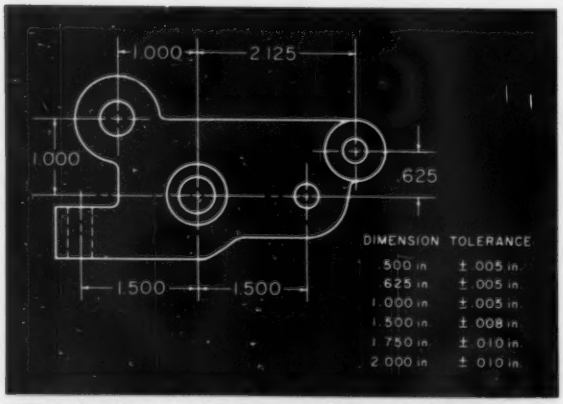
The sketch below shows typical production tolerances which can be held by any foundry to produce castings at minimum cost.

Where it is essential, critical dimensions can be held much more closely than indicated. Such critical dimensions should be called out very sparingly.

Remember, too, there is always the possibility of tolerances adding so that under certain weather conditions, for example, you may get maximum variation.

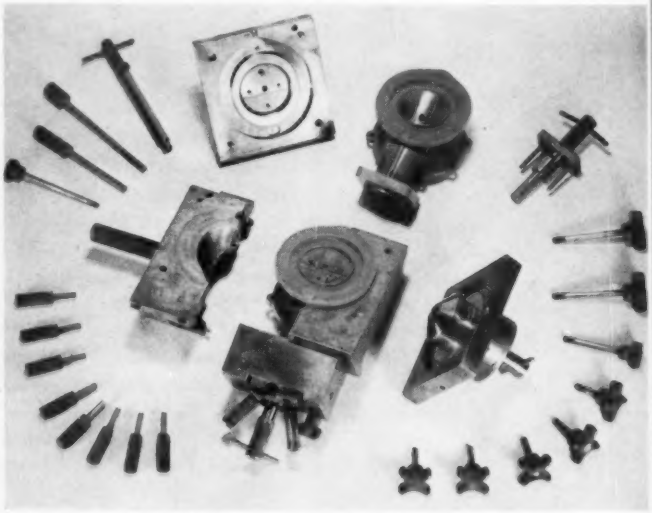
On linear dimensions use ±0.005"/" for functional dimensions and ±1/64 for nonfunctional ones. Angularity, concentricity, flatness, straightness, and roundness should all be given realistically.

Suggested tolerances for the best castings at the lowest cost have been established by the Investment Casting Institute.

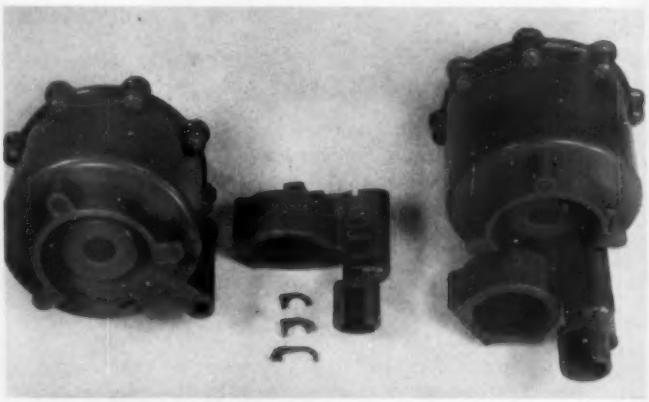


TOLERANCES are given for centerline dimensions.

TOOLING



PATTERN DIE with three-piece collapsible steel core still in place produces pattern at top right.



FIVE PATTERN SEGMENTS at left were produced in three steel dies and then assembled (as shown at right).

Die costs for making investment castings are directly proportional to the intricacy of the pattern. Two factors: production quantities and tolerances will influence type of die, pattern and mold materials to be used. The investment caster can adapt his tooling to either long run or short run work, thus keeping tool costs as low as possible.

Some methods the caster can use to meet special design and production requirements include collapsible cores, soft metal dies, assembled patterns built of several simple subsections, or machined polystyrene patterns for prototypes.

In most cases the same tools can be used for prototype and regular production. While the type of tooling is determined by the investment caster, the designer can help to simplify tooling construction by

establishing datum lines on prints and by providing as much information as possible about service conditions and critical requirements.

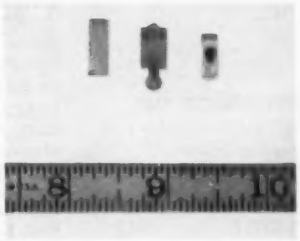
SIZE OF CASTING

Just a few years ago the size of investment castings was limited to small castings. That is, they were about one cubic inch. The only exception to this was when the frozen-mercury process was used where size was not a limiting factor.

Today, this has changed. The parts illustrated are far from the extremes in either largness or smallness. Tiny parts which run hundreds to the teaspoonful are commonly made, and at the other extreme, parts weighing up to 100 lbs. have been made. Probably the average foundry would limit its upper size to under 50 lbs.

When all investment castings were made in metal flasks, the size of the parts was severely limited. Today, however, almost every foundry is equipped to make investment castings using one form or another of the shell mold technique (this should not be confused with shell molding in sand foundries). With this method, size is mostly limited by the material handling and metal melting facilities available.

PROPER DESIGN will minimize gating problems and a good casting will result.



TINY PARTS are possible as both ferrous and nonferrous investment castings.

BUYING INVESTMENT CASTINGS

When a request for bids is sent out the buyer should be certain that all of the necessary information is included and that the information is sufficiently detailed so that all bidders will be sure to submit prices on exactly the same piece. While this may seem elementary, there have been too many cases where specifications were so loosely or poorly drawn the foundry could not be certain just what was wanted. As a result, different bidders made different assumptions and the bids varied widely.

Be certain that dimensional tolerances are as generous as part function will permit. Don't do as some designers have done, specify a 0.003 tolerance on a surface which hung out in air and was nonfunctional.

If mechanical properties are important, spell them out. Remember that there may be, and generally is, a considerable variation between test bar properties and as-cast properties in your configuration. Also be sure to give realistic mechanical requirements. Just because high strength material has been used in the past does not mean that those high properties are required. Always give your vendor a choice of materials when possible. Not all foundries are able to cast all alloys, but they may offer an acceptable alternate.

In requesting prices be sure that the number of pieces is given on a per order basis. If you expect to use 10,000 pieces and will order 200 at a time say so; don't ask for a quotation as though 10,000 were to be delivered at once.

Tooling is generally the property of the buyer. Bids will always show a per piece cost for the casting and a tooling cost. To avoid later arguments, if you should change vendors be sure that the tooling cost includes all charges, engineering, material and labor. It is generally best to put onto your request for bids a notation that tooling charges are to include engineering charges.

If you contemplate moving from one vendor to another be sure that the new vendor can and will use the tools you own. In many cases his equipment may not be able to handle your present tools. In almost every case there will be some charge for tool modification.

Allow plenty of lead time when you place an order. After pattern tooling has been built the average time from receipt of the order to shipment of castings is from four to five weeks. If other than average inspection is required, X-ray for example, allow more lead time.

When possible allow your vendor a flexible delivery schedule. He will be able to integrate your production into his foundry production. The result is always a lower piece cost and better castings.

If you require certification of analysis of metal be sure that this information is included in your original request for bids. This same is true of certification of mechanical properties. Many buyers require test bars cast from the same heat of metal as their castings. This should be part of your original specifications.

It is wise to require sample castings before production starts. This permits a check on design, allows minor changes to be made if needed, and gives time for the buyer to check tools for all secondary operations.

(The material in this report is condensed from the 165 pages of technical data in "How to Design and Buy Investment Castings" published by The Investment Casting Institute, 27 East Monroe St., Chicago, Illinois. Price $3.95)

It's Good Business
To Specify
Investment Castings
From Associated
Members
INVESTMENT CASTING
INSTITUTE
Your production requirements demand quality castings . . . delivered on schedule at minimum cost. Dependable procurement is essential to business success.
Members of the Investment Casting Institute are pledged to maintain the highest standards in the industry. All are staffed to provide expert technical assistance and practical advice. All are equipped to supply close-tolerance castings in production quantities. All are familiar with techniques to improve castings quality and to cut casting costs. It's good business to do business with associated members.

Members of the Investment Casting Institute are located throughout the United States, Canada and England.

ALL METALS PRECISION CASTING CORP.
22 School Street
Yonkers, New York

CASTING ENGINEERS
2327 N. Bosworth Avenue
Chicago 14, Illinois

CONNECTICUT INVESTMENT CASTING CORP.
80 Stillman Avenue
Pawcatuck, Connecticut

ELECTRONICAST Div. of
Nilsen Manufacturing Company
19 N. Church St.
Addison, Illinois

ENGINEERED PRECISION CASTING CO.
Box 299-I
Matawan, New Jersey

GRAY-SYRACUSE, INC.
Manlius 2, New York

HARCAST COMPANY, INC.
6620 East Glenolden Avenue
Glenolden, Penna.
(Philadelphia Suburb)

HITCHINER MANUFACTURING CO., INC.
Milford 5, New Hampshire

LAWRENCE LABORATORY
1668 Euclid Street
Santa Monica 1, California

PRECISION CASTPARTS CORP.
4601 S. E. Harney Drive
Portland 6, Oregon

PRECISION FOUNDERS, INC.
414 Hester St.-A.
San Leandro, California

PRECISION METALSMITHS, INC.
1082 East 200th Street
Cleveland 17, Ohio

K. W. THOMPSON TOOL COMPANY
Denton Ave. & 1st Place
New Hyde Park, L.I., N.Y.

IN CANADA

CERCAST, INC.
83 St. Agathe St.
Montreal 18, Canada

DELORO STELLITE
Division of Deloro Smelting & Refining Company, Ltd.
P. O. Box 341
Belleville, Ontario, Canada

IN ENGLAND

TRUCAST LIMITED
Farnham Royal Lodge
Buckinghamshire, England

INVESTMENT CASTING INSTITUTE

27 EAST MONROE STREET • CHICAGO 3, ILLINOIS

6th annual INVESTMENT CASTING DIRECTORY

INVESTMENT CASTINGS

FERROUS

Aerospace Castings, Inc.
4520 Brazil St., Los Angeles 39, Calif.

All Metal Precision Casting Corp.
22 School St., Yonkers, N. Y.

Alloy Steel Casting Co.
Southampton, Pa.

Artco, Inc.
31915 Groesbeck Hwy., Fraser, Mich.

Arwood Corp.
321 West 44th St., New York 36, N. Y.

Austenal Co.
Div. of Howe Sound Co.
Microcast Products
230 Park Ave., New York 17, N. Y.

Allen Benjamin-Metallurgical Specialists
P. O. Box 340, Tempe, Ariz.

B-Mold Div.
Buckeye Brass & Mfg. Co.
203 Central Ave., Mansfield, Ohio

Brace Inc.
6237 Penn Ave., S., Minneapolis 23, Minn.

Cadmet Corp.
20801 Ryan Rd., Detroit, Mich.

California Precision Castings, Inc.
1721 Standard Ave., Glendale 1, Calif.

Castall Precision Products
1911 West Cullerton, Chicago 8, Ill.

Casting Engineers
2322 Bosworth Ave., Chicago 14, Ill.

Casting Engineers
Div. of Consolidated Foundries
& Mfg. Corp.
615 West 131st St., New York 27, N. Y.

Centrifugal Casting Co.
3245 Cherry Ave., Long Beach 7, Calif.

Cercast Inc.
83 St. Agatha Lane
Montreal, Quebec, Can.

Chicago Vacuum Casting Co.
2110 W. Grand Ave., Chicago 12, Ill.

Connecticut Investment Casting Corp.
Stillman Ave., Pawcatuck, Conn.

Cooper & Schuber
5275 East Washington Blvd.
Los Angeles 22, Calif.

Dean Casting & Mfg. Co.
1220 South Third St.
Minneapolis 15, Minn.

Deloro Stellite
Div. of Deloro Smelting & Refining
Co., Ltd.
P. O. Box 341, Belleville, Ontario, Can.

Designed Precision Castings, Ltd.
75 Eastern Ave., Brampton, Ontario, Can.

Engineered Precision Casting Co.
P. O. Box 299-1, Matawan, N. J.

Gray-Syracuse, Inc.
116 West Seneca, Manlius, N. Y.

Harcast Co., Inc.
620 East Glenolden Ave., Glenolden, Pa.

Haynes Stellite Co.
Div. of Union Carbide Corp.
1020 West Park Ave., Kokomo, Ind.

Hitchiner Mfg. Co.,
P. O. Box 232, Milford, N. H.

Howard Foundry Co.
1700 North Kostner Ave., Chicago 39, Ill.

Howe Sound Co.
500 Fifth Ave., New York 36, N. Y

Humphrey Castings, Inc.
3944 Riley St., San Diego 10, Calif

Illinois Precise Casting Co.
10530 West Anderson Place
Franklin Park, Ill.

Independent Steel Casting Co., Inc.
P. O. Box 157, U. S. 12 & Grand Ave.
New Buffalo, Mich.

Industrial Overlay Metals, Inc.
Eaton, Ohio

Investment Casting Co.
60 Brown Ave., Springfield, N. J.

Investment Casting Co.
Saegertown Rd., R. D. 3, Meadville, Pa.

Joseff
129 East Providencia Ave., Burbank, Calif.

Kadee Metal Products Co.
720 South Grape, Medford, Oreg.

Kolcast Industries, Inc.
P. O. Box 250, Minerva, Ohio

La Donn Castings, Inc.
12337 Branford St., Sun Valley, Calif.

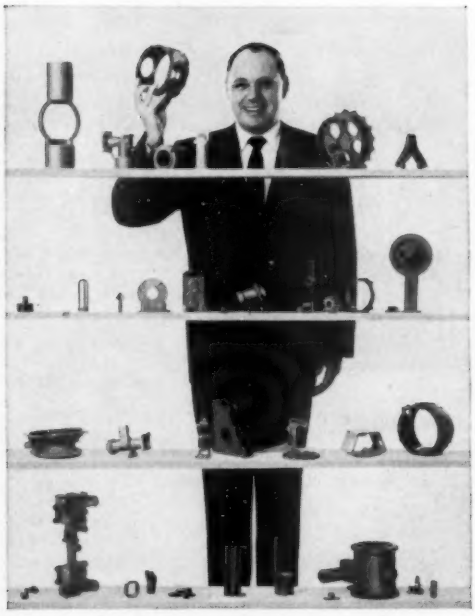
Philip Laurence Co.
269 West 125th St., New York 27, N. Y.

Liebros Casting Co.
39-30 Review Ave., Long Island City, N. Y.

Bold face listings are advertisers in this issue.

Because we've always welcomed "little" jobs, too—

We've become the biggest in the investment casting field...



No investment casting job has ever been or ever will be too small for us.

WE DON'T HAVE ANY "SIDELINES," nor is investment casting only a sideline with us. It is the "be-all and end-all" of our economic existence.

AS A RESULT: anybody who thinks that an investment casting will help him solve a problem gets the unqualified, attention of the top talent we have to offer—from our trained field engineers, our design engineers, our estimating staff, our tooling men, and our production specialists. No one of these groups cares whether your order is for 50 parts or 100,000. If they accept the order, they want it handled to or above "specs".

WHY? SIMPLY BECAUSE THESE MEN ARE DEDICATED to producing the finest that the process can deliver in any design, in any castable alloy and in quantities so small that it might surprise you.

THEIR ATTITUDE IS FAR FROM PHILANTHROPIC; they realize full well that your "little ones" may soon grow up.

ARWOOD IS READY WHEN THEY DO... more so than any other investment caster. In fact, we can take in stride all the volume that's required. Our five plants, each fully integrated, can handle the biggest job you can offer.

ONCE THE PROTOTYPE PHASE IS COMPLETED, Arwood can give you the quantity production you need, and deliver it when you need it.

WHAT MORE CAN WE SAY? Simply this. Most "difficult" components, no matter what the alloy or quantity, might well be produced as an Arwood investment casting... and THE COST IS OFTEN EXTREMELY LOW, compared with conventional methods.

ON THE OTHER HAND, IF WE CAN'T DO IT—and do it economically—we'll be the first to tell you so immediately. We'd rather lose an order than a customer. Try us and see.

ARE YOU REALLY UP-TO-DATE ON WHAT INVESTMENT CASTING CAN DO? Our 48-page "Practical Guide" gives forthright answers... tells how to design for the process, gives complete tables on properties. It's yours for the asking.

Machine the simple... cast the complex

A complete service from design through tooling, production and finish machining. Seventy-one engineering representatives from coast to coast.

arwood

ARWOOD CORPORATION • **323 West 44th Street, New York 36, New York**

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; GROTON, CONN.; LOS ANGELES AND LA VERNE, CALIF.

Circle No. 11 on Reader Service Card

Bold face listings are advertisers in this issue.

Lynn Casting Corp.
3014 Floyd St., Burbank, Calif.

M & M Precision Casting Co.
P. O. Box 295, Norwood, Mass.

Manco Products, Inc.
2401 Schaefer Rd., Melvindale, Mich.

The Manell Co.
29 Locust St., West Haven, Conn.

Mercast Div.
Arwood Corp.
2620 First St., La Verne, Calif.

Metal Atomizing & Processing Corp., Ltd.
P. O. Box 325, 1437-39 Speers Rd.
Oakville, Ontario, Can.

Midwest Precision Castings Co.
10703 Quincy Ave., Cleveland, Ohio

Misco Precision Casting Co.
116 Gibbs St., Whitehall, Mich.

National Precision Casting Div.
General Casting Corp.
P. O. Box 396 Paoli, Pa.

W. R. Newman Precision Casting
317 South Main St., Freeport, L. I., N. Y.

Nilsen Mfg. Co.
Electronicast Div.
21 North Church St., Addison, Ill.

Omni-Metal Castings, Inc.
135 Eleventh St., Brooklyn 15, N. Y.

Perfect Casting
671 Flushing Ave., Brooklyn, N. Y.

Picco Industries
1729 North Chico Ave., El Monte, Calif.

Precision Castparts Corp.
4600 S. E. Harney Dr., Portland 6, Oreg.

Precision Founders, Inc.
414 Hester St., San Leandro, Calif.

Precision Foundries, Inc.
2669 Larimer, Denver 17, Colo.

Precision Metalsmiths, Inc.
1081 East 200th St., Cleveland 17, Ohio

Precision Metalsmiths, Inc.
Intricast Div.
1 Madison St., Loundonville, Ohio

Rex Precision Products, Inc.
11825 Major St., Culver City, Calif.

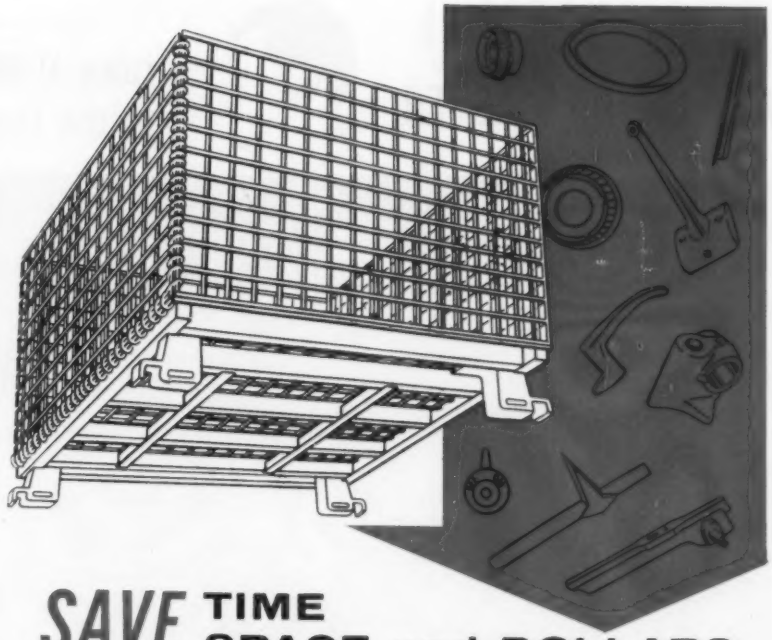
Rimer Precision Casting, Inc.
Farnsworth Rd., Waterville, Ohio

Frank Roth Co., Inc.
4280 Park Ave., Bronx, N. Y.

Scott Casting and Manufacturing Co.
Div. of Rolle Mfg. Co., Inc.
3rd St. & Cannon Ave., Lansdale, Pa.

Signicast Corp., 2629 South Greeley St.
Milwaukee 7, Wis.

Standard Tool Co.
Hamilton St., Leominster, Mass.



SAVE TIME SPACE and DOLLARS FOR DIE CASTING PLANTS . . . . . EVERYWHERE!

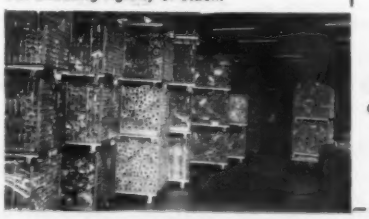
USP PALLETAINERS

Palletainers have simplified material handling problems for Die Casting plants and foundries from coast to coast. These versatile, practically indestructible containers will save time, money and manpower on the production line, in storage and shipping. And . . . Palletainers carry loads of 500 to 6,000 pounds with perfect safety. Form-welded steel legs provide 8-way entry for fork trucks and safe, ceiling-high stacking. Full visibility permits speedy inventory and the sturdy welded steel mesh protects cargo perfectly.

No matter what you manufacture—store or ship, *you need Palletainers!*

Palletainers simplify working storage—save valuable floor space. Stack safely with contents visible.

Palletainers afford a versatile warehouse bin arrangement. Palletainers with side or end gates may be opened or closed without affecting rigidity of stack.



SPECIAL OFFER

You can try Palletainers right in your own plant on a 60-day memo billing basis. Your obligation is freight only!

UNION STEEL PRODUCTS CO.
550 N. Berrien St., Albion, Michigan

Gentlemen: Please send me complete information on USP Palletainers. ☐

Please have a USP Material Handling Engineer contact me at once. ☐

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Circle No. 62 on Reader Service Card

Why the DIE CASTER

talks D-M-E STANDARD UNIT DIES to the Die Designer and Die Maker

Changeover time goes down ...Profits on short runs go up!

Die changes on zinc or aluminum castings which normally take 3 to 5 hours are now done in minutes with D-M-E Standard Unit Dies.

D-M-E Replacement Units are fully interchangeable: Quickly and easily they're taken out and replaced in the Unit Holder . . . production is continued immediately!

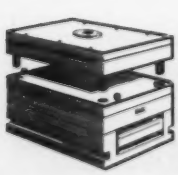
Because several jobs can run on one machine, you increase profits on short run jobs. What's more, you get the quality, the performance and the standardization of replacement parts needed for volume production work.

DIE CASTERS, DESIGNERS AND DIE MAKERS GET MORE FROM D-M-E!

• AVAILABILITY: D-M-E Replacement Units are carried in stock at your local D-M-E Branch for quick delivery. • VARIETY: D-M-E Replacement Units are available in your choice of steel and hardness. • UTILITY: D-M-E has a Standard Unit Die to fit your machine, whether you require rack and pinion or automatic "bumper-type" ejection. • FLEXIBILITY: Complete freedom on three sides of the cavity for core or cooling line placement; six leader pins and bushings for accurate alignment; "quick change" wedge clamps for positive plate positioning. • Start increasing profits on your short-run jobs with D-M-E Standard Unit Dies!

Write for your free copy of *Lower Die Cost Through Standardization.*

61-A-DC



DETROIT MOLD ENGINEERING COMPANY

6686 E. McNichols Road — Detroit 12, Michigan — TWinbrook 1-1300

Chicago • Hillside, N. J. • Los Angeles • D-M-E Corp., Cleveland, Dayton
D-M-E of Canada, Inc., Toronto

Injection and Compression Mold Bases • Injection Unit Molds • Cavity Retainer Sets • Mold Plates • Ejector and Core Pins
Ejector Sleeves • Leader Pins and Bushings • Sprue Bushings • Moldmakers' Tools and Supplies

Circle No. **23** on Reader Service Card

Bold face listings are advertisers in this issue.

Suffolk Precision Casting Co., Inc.
137 Old Commock, Kings Park, L. I., N. Y.

Supreme Precision Castings, Ltd.
550 Montee De Liesse
Montreal, Quebec, Can.

K. W. Thompson Tool Co., Inc.
20 Denton Ave.
New Hyde Park, L. I., N. Y.

Truecast Precision Casting Co.
133 N. W. 16th St., Boca Raton, Fla.

Truecast Precision Casting Co.
1379 South 7th St., Louisville 8, Ky.

Turbo Cast, Inc.
1860 East Gage Ave., Los Angeles, Calif.

Vac Alloys, Inc.
Fallon Industries Div.
17695 Filer St., Detroit, Mich.

Vascoloy-Ramet Corp.
800 Market St., Waukegan, Ill.

Wesco Casting Co.
219 Rose Ave., Venice, Calif.

Westinghouse Electric Corp.
Metals Plant, P. O. Box 128
Blairsville, Pa.

Witkin Precision Castings
201 East 126, New York 35, N. Y.

York Castings, Inc.
32 Latta Rd., Rochester 12, N. Y.

Z & H Manufacturing Co.
Div. of General Casting Corp.
1000 North Division St., Peekskill, N. Y.

Zenith Precision Casting Co.
130 West 46th St., New York, N. Y.

NON-FERROUS

Aerospace Castings, Inc.
4520 Brazil St., Los Angeles 39, Calif.

Airtron
A Div. of Litton Industries
1301 East Linden Ave., Linden, N. J.

All Alloy Precision Cast
118 Sheldon Ave., S. E.
Grand Rapids 2, Mich.

All Metal Precision Casting Corp.
22 School St., Yonkers, N. Y.

Alloy Steel Casting Co.
Southampton, Pa.

Arrow Acme Corp.
411 Prospect, Webster City, Iowa

Artco, Inc.
31915 Groesbeck Hwy., Fraser, Mich.

Artec Manufacturing Co.
7031 Canby Ave., Reseda, Calif.

Arwood Corp.
321 West 44th St., New York 36, N. Y.

Circle No. 86 on Reader Service Card

INVESTMENT CASTINGS

"Lost Wax Process"

Finished to Your Requirements
Ideas - Engineering - Proto Types -Short Runs
High Production Runs

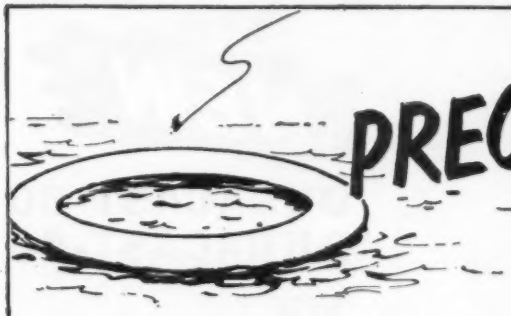
For Castings Average or Complex with Complete Range of Ferrous and Non Ferrous Materials.

Call us for Quick Delivery & Economical Production in Low & High Volume Parts.

PROMPT QUOTATIONS — WRITE OR CALL

INDEPENDENT STEEL CASTING CO., INC.

P. O. BOX 157, U. S. 12 & GRAND AVE.
NEW BUFFALO, MICHIGAN
TELEPHONE 973



PRECISION CASTING

Increase your profits with DFC crucibles & funnels

Since 1876, DFC has furnished crucibles, clay goods, and accessory materials which have set *standards of quality the world over.* More recently the unanimous acceptance and wide use of DFC transfer crucibles and funnels by the precision casting industry, is high testimony to their economy and dependability.

For precision casting…lost wax, investment and permanent mold. Transferring, pouring, spouting… there is a DFC crucible or funnel to meet your exact needs.

If you have a special crucible problem, let us work on it for you.

Denver Fire Clay Company

DENVER • SALT LAKE CITY • NEW YORK

The DENVER FIRE CLAY COMPANY **DFO-5**
3037 Blake Street, Denver 17, Colorado

Please send me further information on your full line of crucibles.

Name.....

Company.....

Address.....

City and State.....

Circle No. 68 on Reader Service Card

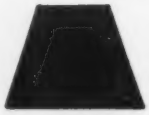
Cut Pattern Costs

with YATES wax shapes

Free your equipment for production jobs . . . Yates extruded shapes speed your wax assembly. Strong but not brittle, they can be shaped easily without cracking. There's a shape in stock for just about any job you may have . . . . all shapes available solid or cored.

For example:

ROUNDS
23 sizes
(⅛" to 3½")



WEDGES
10 sizes
(1/16" to ⅞")

RECTANGLES
29 sizes
(1/16" to 3")

TRIANGLES
6 sizes
(¾" to 2")

HALF-ROUNDS, SEGMENTS
11 sizes
(¼" to 1¼")

SQUARES
20 sizes
(⅛" to 2")

A complete new catalog is yours on request from

YATES MFG. CO.

340 WEST HURON STREET
CHICAGO 10, ILLINOIS

Representatives:

EAST COAST:	WEST COAST:
Casting Supply House	Mr. Robert Hirsch
New York City	20646 Bryant St.
	Canoga Park, Calif.

Circle No. **78** on Reader Service Card

Bold face listings are advertisers in this issue.

Atlantic Casting & Engineering Corp.
810 Bloomfield Ave.
Clifton, N. J.

Allen Benjamin-Metallurgical Specialists
P. O. Box 340, Tempe, Ariz.

B-Mold Div.
Buckeye Brass & Mfg. Co.
203 Central Ave., Mansfield, Ohio

Brace Inc.
6237 Penn Ave., S., Minneapolis 23, Minn.

Cadmet Corp.
20801 Ryan Rd., Detroit, Mich.

California Precision Castings, Inc.
1721 Standard Ave., Glendale 1, Calif.

Castall Precision Products
1911 West Cullerton, Chicago 8, Ill.

Casting Engineers
2323 Bosworth Ave., Chicago 14, Ill.

Casting Engineers
Div. of Consolidated Foundries & Mfg. Corp.
615 West 131st St., New York 27, N. Y.

Centrifugal Casting Co.
17 West 60th St., New York 23, N. Y.

Cercast, Inc.
83 St. Agatha Lane
Montreal, Quebec, Can.

Chicago Vacuum Casting Co.
2110 W. Grand Ave., Chicago 12, Ill.

Connecticut Investment Casting Corp.
Stillman Ave., Pawcatuck, Conn.

Cooper & Schuber
5275 East Washington Blvd.
Los Angeles 22, Calif.

Cranston Casting Co.
52 Pavilion Ave., Cranston, R. I.

Dean Casting & Mfg. Co.
1220 South Third St.
Minneapolis 15, Minn.

De Freece Precision Metal Castings
P. O. Box 493, Bellevue, Wash.

Deloro Stellite
Div. of Deloro Smelting & Refining Co., Ltd.
P. O. Box 341, Belleville, Ontario, Can.

Designed Precision Castings, Ltd.
75 Eastern Ave.
Brampton, Ontario, Can.

Engineered Precision Casting Co.
P. O. Box 299-I, Matawan, N. J.

Ferriot Bros., Inc.
2685 Mogadore Rd., Akron 5, Ohio

Gorham Electronics
Div. of Gorham Mfg. Co.
333 Adelaide Ave., Providence 7, R. I.

Gray-Syracuse, Inc.
116 West Seneca, Manlius, N. Y.

Hampshire Casting Co.
11 Davis, Easthampton, Mass.

The Hansen Studios
4115 Q St., Vancouver, Wash.

Harcast Co., Inc.
620 East Glenolden Ave., Glenolden, Pa.

your industrial
WORKHORSE

DURACAST
investment

NEW*

*DURACAST-30
*DURACAST-40

NEW workhorses for you. Write now for literature on new Duracast-30 and Duracast-40. Learn what they can do for you.

For Non-Ferrous Metals
K-90
DURACAST
DURACAST-20

Backups for Ferrous Castings
FERROMOLD-VACUUM TYPE
VIBRAPOUR-VIBRATING TYPE

KERR MANUFACTURING CO.
6081 Twelfth St. • Detroit 8, Michigan

DEALERS
CASTING SUPPLY HOUSE • New York, New York
DICK ELLS CO. • Los Angeles, California

Circle No. **39** on Reader Service Card
PRECISION METAL MOLDING

Example of lost-wax casting from the ancient kingdom of Benin in Nigeria, dating back to sixteenth century. Courtesy of the Museum of Primitive Art, New York.

heritage of craftsmanship... Among the techniques that craftsmen have painstakingly developed through the ages to achieve ever greater mastery over metal is lost-wax casting, better known today as investment casting. At Investment Casting Company this method has now been brought to new heights of precision and versatility for casting the most intricate precision parts in most ferrous and non-ferrous alloys. We would be pleased to confer with you regarding the advantages and economies of investment-casting your parts and sub-assemblies. Send prints for quotations, or ask for representative to call.

INVESTMENT CASTING CO.

Subsidiary of Faradyne Electronics Corp.
60-A Brown Avenue, Springfield, N. J.

Circle No. 67 on Reader Service Card

Bold face listings are advertisers in this issue.

Haynes Stellite Co.
Div. of Union Carbide Corp.
1020 West Park Ave., Kokomo, Ind.

Hitchiner Mfg. Co.,
P. O. Box 232, Milford, N. H.

Howard Foundry Co.
1700 North Kostner Ave., Chicago 39, Ill.

Howe Sound Co.
500 Fifth Ave., New York 36, N. Y.

Humphrey Castings, Inc.
3944 Riley St., San Diego 10, Calif.

Illinois Precise Casting Co.
10530 West Anderson Place
Franklin Park, Ill.

Independent Steel Casting Co., Inc.
P. O. Box 157, U. S. 12 & Grand Ave.
New Buffalo, Mich.

Industrial Overlay Metals, Inc.
Eaton, Ohio

Investment Casting Co.
60 Brown Ave., Springfield, N. J.

Investment Casting Co.
Saegertown Rd., R. D. 3, Meadville, Pa.

Iremic Precision Casting Co.
25 Spruce St., New York 38, N. Y.

Joseff
129 East Providencia Ave., Burbank, Calif.

Kadee Metal Products Co.
720 South Grape, Medford, Oreg.

Kemtron Products Co.
750 Fulton St., Fresno, Calif.

Kolcast Industries, Inc.
P. O. Box 250, Minerva, Ohio

La Donn Castings, Inc.
12337 Branford St., Sun Valley, Calif.

Philip Laurence Co.
269 West 125th St., New York 27, N. Y.

Lawrence Laboratory
1668 Euclid, Santa Monica, Calif.

Liebros Casting Co.
39-30 Review Ave., Long Island City, N. Y.

Lynn Casting Corp.
3014 Floyd St., Burbank, Calif.

M & M Precision Casting Co.
P. O. Box 295, Norwood, Mass.

Manco Products, Inc.
2401 Schaefer Rd., Melvindale, Mich.

The Manell Co.
29 Locust St., West Haven, Conn.

Martin Oil Tool Co.
Route 1, P. O. Box 472, Brazoria, Tex.

Mercast Div.
Arwood Corp.
2620 First St., La Verne, Calif.

Metal Atomizing & Processing Corp., Ltd.
P. O. Box 325, 1437-39 Speers Rd.
Oakville, Ontario, Can.

Midwest Precision Castings Co.
10703 Quincy Ave., Cleveland, Ohio

Misco Precision Casting Co.
116 Gibbs St., Whitehall, Mich.

National Cast Products Co., Inc.
121 Dyer St., Providence 3, R. I.

National Precision Casting Div.
General Casting Corp.
P. O. Box 396, Paoli, Pa.

W. R. Newman Precision Casting
317 South Main St., Freeport, L. I., N. Y.

Nilsen Mfg. Co.
Electronicast Div.
21 North Church St., Addison, Ill.

Omni-Metal Castings, Inc.
135 Eleventh St., Brooklyn 15, N. Y.

Pal Engineering Ltd.
614 First St., S. W., Cedar Rapids, Iowa

Perfect Casting
671 Flushing Ave., Brooklyn, N. Y.

Perficast Corp.
71 West 47th St., New York 36, N. Y.

Picco Industries
1729 North Chico Ave., El Monte, Calif.

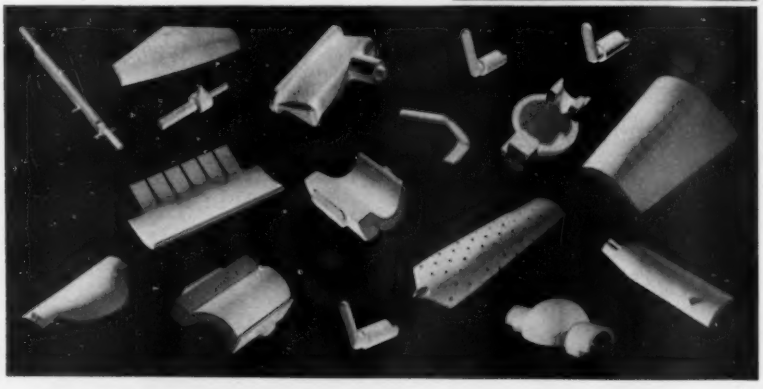
Precision Castparts Corp.
4600 S. E. Harney Dr., Portland 6, Oreg.

Precision Founders, Inc.
414 Hester St., San Leandro, Calif.

Precision Foundries, Inc.
2669 Larimer, Denver 17, Colo.

For high-precision hollow castings from any alloy... in any configuration

Sherwood Ceramic Preformed Cores



The Sherwood Process assures close-tolerance coring accuracy, produces hollow sections without design compromise . . . cuts production costs

Sherwood ceramic preformed cores are custom designed to exacting tolerances to produce smooth, as-cast internal surfaces, specific wall thicknesses. Substantially volume stable and containing no residual gas, they may be used with vacuum-cast or air-cast alloys at temperatures in excess of 3000°F without fracture or distortion.

Sherwood cores overcome disadvantages of conventional coring techniques. Custom formulae for each application eliminate metal/core reactions and assure complete compatability with all methods of precision casting.

Sherwood cores are proving themselves in countless critical applications . . . everywhere.

Send for technical design data!

Sherwood Refractories
Division of H. J. Sherwood, Inc.
16601 Euclid Avenue • Cleveland 12, Ohio

Circle No. **87** on Reader Service Card

Precision Metalsmiths, Inc.
1081 East 200th St., Cleveland 17, Ohio

Precision Metalsmiths, Inc.
Intricast Div.
1 Madison St., Loundonville, Ohio

Rausch Manufacturing Co., Inc.
750 Pelham Blvd., St. Paul 14, Minn.

Rex Precision Products, Inc.
11825 Major St., Culver City, Calif.

Rimer Precision Casting, Inc.
Farnsworth Rd., Waterville, Ohio

Rode, Inc.
R. 5 Green St., Woburn, Mass.

Frank Roth Co., Inc.
4280 Park Ave., Bronx, N. Y.

A. M. Schaler, Inc.
69 Valley St., Providence 9, R. I.

Scientech Co.
P. O. Box 511, Independence, Kans.

Scott Casting and Manufacturing Co.
Div. of Rolle Mfg. Co., Inc.
3rd St. & Cannon Ave., Lansdale, Pa.

Standard Tool Co.
Hamilton St., Leominster, Mass.

Suffolk Precision Casting Co., Inc.
137 Old Commock, Kings Park, L. I., N. Y.

Supreme Precision Castings, Ltd.
550 Montee De Liesse
Montreal, Quebec, Can.

K. W. Thompson Tool Co., Inc.
20 Denton Ave.,
New Hyde Park, L. I., N. Y.

Truecast Precision Casting Co.
133 N. W. 16th St., Boca Raton, Fla.

Truecast Precision Casting Co.
1379 South 7th St., Louisville 8, Ky.

Turbo Cast, Inc.
1860 East Gage Ave., Los Angeles, Calif.

United Refining & Smelting Co.
2920 West Carroll Ave., Chicago, Ill.

Valen-Cast, Inc.
128 South Bielec Lane
City of Industry, Calif.

Vascoloy-Ramet Corp.
800 Market St., Waukegan, Ill.

Vesuvius Crucible Co.
2216 Palmer St., Swissvale, Pittsburgh, Pa.

Wesco Casting Co.
219 Rose Ave., Venice, Calif.

Witkin Precision Castings
201 East 126, New York 35, N. Y.

York Castings, Inc.
32 Latta Rd., Rochester 12, N. Y.

Z & H Manufacturing Co.
Div. of General Casting Corp.
1000 North Division St., Peekskill, N. Y.

Zenith Precision Casting Co.
130 West 46th St., New York, N. Y.

PRECIOUS METALS

A. L. A. Casting Co.
37 West 47th St., New York 36, N. Y.

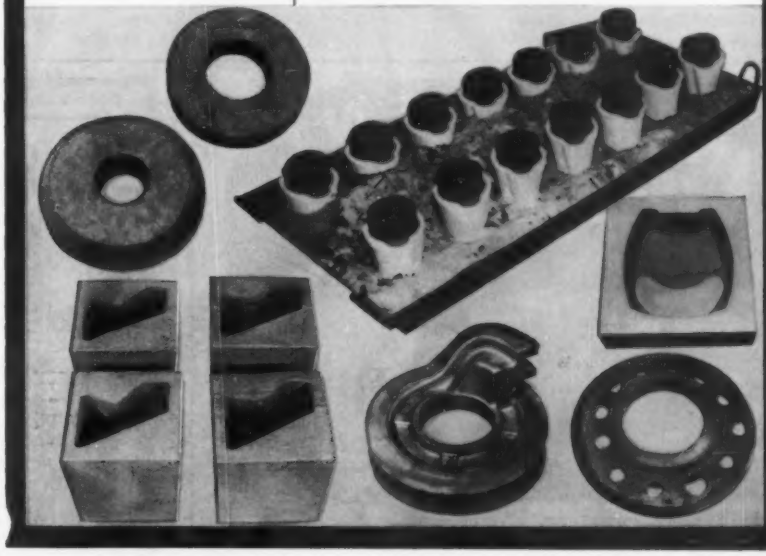
Aerospace Castings, Inc.
4520 Brazil St., Los Angeles 39, Calif.

NOW VANADIUM-ALLOYS TOOL AND SPECIAL STEELS

cast to shape

TO YOUR PARTICULAR REQUIREMENTS

STANDARD GRADES	**FORMEX**—a 5% chrome hot work die steel **AIREX**—a 5% chrome cold work, air hardening die steel **CROMEX**—a 12% chrome cold work die steel
SPECIAL COMPOSITIONS	Available to customer specifications
TYPICAL APPLICATIONS	Forming rolls, cams, drop forge trimming die, forming or blanking dies, molds, draw rings



In our new and completely equipped department for Cast-to-Shape steels, versatile production and prompt deliveries are outstanding features. Employing conventional sand casting, precision Shaw Process casting or shell molding, you are served with varied melting furnace capacities from 30 to 2000 lbs—assuring best economy in meeting any standard or special analyses you may require. Let us serve you!

FIRST QUALITY · TOOL & SPECIAL STEELS · VA

VANADIUM-ALLOYS STEEL COMPANY
LATROBE, PENNSYLVANIA

Circle No. 89 on Reader Service Card

Bold face listings are advertisers in this issue.

All Alloy Precision Cast
118 Sheldon Ave., S. E.
Grand Rapids 2, Mich.

Artec Manufacturing Co.
7031 Canby Ave., Reseda, Calif.

Arwood Corp.
321 West 44th St., New York 36, N. Y.
(silver, gold, platinum)

Allen Benjamin-Metallurgical Specialists
P. O. Box 340, Tempe, Ariz.

B-Mold Div.
Buckeye Brass & Mfg. Co.
203 Central Ave., Mansfield, Ohio

Brace, Inc.
6237 Penn Ave., S. Minneapolis 23, Minn.

Cadmet Corp.
20801 Ryan Rd., Detroit, Mich.

Centrifugal Casting Co.
17 West 60th St., New York 23, N. Y.

Cooper & Schuber
5275 East Washington Blvd.
Los Angeles 22, Calif.

Cranston Casting Co.
52 Pavilion Ave., Cranston, R. I.

Dean Casting & Mfg. Co.
1220 South Third St.
Minneapolis 15, Minn.

Investment Casting Co.
Saegertown Rd., R. D. 3, Meadville, Pa.

Iremic Precision Casting Co.
25 Spruce St., New York 38, N. Y.

Joseff
129 East Providencia Ave., Burbank, Calif.

Kemtron Products Co.
750 Fulton St., Fresno, Calif.

Philip Laurence Co.
269 West 125th St., New York 27, N. Y.

Lynn Casting Corp.
3014 Floyd St., Burbank, Calif.

Martin Oil Tool Co.
Route 1, P. O. Box 472, Brazoria, Tex.

Midwest Precision Castings Co.
10703 Quincy Ave., Cleveland, Ohio

National Cast Products Co., Inc.
121 Dyer St., Providence 3, R. I.

W. R. Newman Precision Casting
317 South Main St., Freeport, L. I., N. Y.

Perfect Casting
671 Flushing Ave., Brooklyn, N. Y.

Perficast Corp.
71 West 47th St., New York 36, N. Y.

Precision Castparts Corp.
4600 S. E. Harney Dr., Portland 6, Oreg.

Precision Foundries, Inc.
2669 Larimer, Denver 17, Colo.

Rausch Manufacturing Co., Inc.
750 Pelham Blvd., St. Paul 14, Minn.

Rimer Precision Casting, Inc.
Farnsworth Rd., Waterville, Ohio

A. M. Schaler, Inc.
69 Valley St., Providence 9, R. I.

Scientech Co.
P. O. Box 511, Independence, Kans.

Scott Casting and Manufacturing Co.
Div. of Rolle Mfg. Co., Inc.
3rd St. & Cannon Ave., Lansdale, Pa.

L. E. Simmons Refining Co.
440 North Orleans St., Chicago 10, Ill.

Witkin Precision Castings
201 East 126, New York 35, N. Y.

York Castings, Inc.
32 Latta Rd., Rochester 12, N. Y.

Z & H Manufacturing Co.
Div. of General Casting Corp.
1000 North Division St., Peekskill, N. Y.

Zenith Precision Casting Co.
130 West 46th St., New York, N. Y.

OTHER METALS

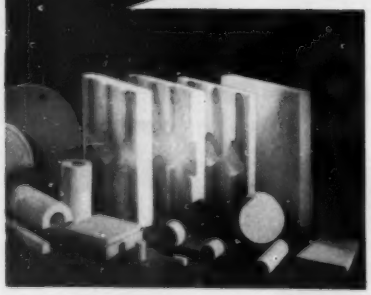
Aerospace Castings, Inc.
4520 Brazil St., Los Angeles 39, Calif.

Alloy Steel Casting Co.
Southampton, Pa.

Arwood Corp.
321 West 44th St., New York 36, N. Y.
(magnesium)

Cadmet Corp.
20801 Ryan Rd., Detroit, Mich.

INVESTMENT CASTING ?



Filtros
POROUS DIFFUSER PLATES

are ideal diffusers for Fluid Bed Particle Coating of Investment Patterns and Shell Mold Patterns.

Wide range of sizes, shapes, and pore diameters are

IN STOCK for IMMEDIATE SHIPMENT.

Learn more about this fluid bed method of casting patterns, using FILTROS Porous Ceramic Diffuser Plates. Circular on request to

FILTROS INCORPORATED
607 W. Commercial St.
East Rochester 2, N. Y.

Circle No. **90** on Reader Service Card

quality
INVESTMENT CASTINGS
delivered on time!

● Assure the success of your investment casting designs. Send them to Midwest Precision, which has an enviable background of many years of experience in the field.

Among the great number of investment castings successfully mass-produced by Midwest, are many parts on which other foundries failed. Our engineers and technicians make available to YOU, without obligation, their full store of accumulated precision casting knowledge.

To be sure of your investment cast parts, submit them to Midwest for a completely unbiased evaluation.

FREE Send for your copy of "How To Design Investment Castings"

MIDWEST PRECISION CASTINGS CO.
10703-7 QUINCY • CLEVELAND 6, OHIO
GArfield 1-1918
A-3119

Circle No. **45** on Reader Service Card

pure nickel for critical alloying

When the specifications call for *pure* nickel, you can count on Sherritt as a reliable source of supply. Sherritt's unique hydrometallurgical refining process yields nickel powders with a purity of 99.9%. This high-purity nickel comes to you in handy briquettes and in three grades of powder for faster, easier alloying. The low chilling property of Sherritt briquettes and powders makes them particularly desirable for alloying additions at the end of the heat. Special nickel grades and coated powders are also available. FOOTE MINERAL COMPANY *is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For complete illustrated brochure with prices and delivery information, contact the Foote Mineral Company, 474S Eighteen West Chelten Building, Philadelphia 44, Pa.*

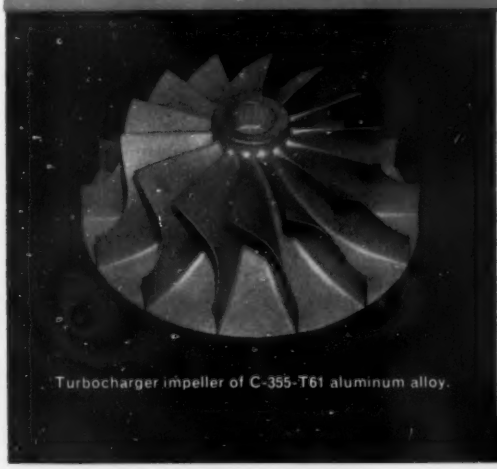
SHERRITT GORDON MINES LIMITED

Circle No. 56 on Reader Service Card

NOW! ALUMINUM INVESTMENT CASTINGS BY MISCO'S

MONO-SHELL

PROCESS!



Turbocharger impeller of C-355-T61 aluminum alloy.

Aircraft valve bodies of 356-T7 aluminum alloy. Wax pattern assembly, MONO-SHELL ceramic-dip slurry after firing, and finished casting.

Misco's capability has met the demand of government agencies and industries for high integrity, high quality ALUMINUM components of maximum physical properties. Significant results have been attained by adapting Misco's MONO-SHELL investment casting process for the production of aluminum components for specific applications.

Investment castings of aluminum alloys.

WE WELCOME INQUIRIES ABOUT THIS NEW PROCESS.

Misco Precision Casting Company

DIVISION OF HOWE SOUND COMPANY

MISCO

MONO-SHELL

Address inquires to
122 Gibbs Street, Whitehall, Michigan
Telephone TWinoaks 3-1515
Circle **47** on Reader Service Card

Bold face listings are advertisers in this issue.

California Precision Castings, Inc.
1721 Standard Ave., Glendale 1, Calif.

Castall Precision Products
1911 West Cullerton, Chicago 8, Ill.

Casting Engineers
2323 Bosworth Ave., Chicago 14, Ill.
(cobalt base)

Centrifugal Casting Co.
3245 Cherry Ave., Long Beach 7, Calif.

Centrifugal Casting Co.
17 West 60th St., New York 23, N. Y.

Deloro Stellite
Div. of Deloro Smelting & Refining Co., Ltd.
P. O. Box 341, Belleville, Ontario, Can.
(cobalt and nickel base alloys)

Engineered Precision Casting Co.
P. O. Box 299-1, Matawan, N. J.

Gray-Syracuse, Inc.
116 West Seneca, Manlius, N. Y.

Illinois Precise Casting Co.
10530 West Anderson Place
Franklin Park, Ill.

Kadee Metal Products Co.
720 South Grape, Medford, Oreg.

Metal Atomizing & Processing Corp., Ltd.
P. O. Box 325, 1437-39 Speers Rd.
Oakville, Ontario, Can.

Midwest Precision Castings Co.
10703 Quincy Ave., Cleveland, Ohio

National Cast Products Co., Inc.
121 Dyer St., Providence 3, R. I.
(lead and tin base alloys)

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Omni-Metal Castings, Inc.
135 Eleventh St., Brooklyn 15, N. Y.

Perficast Corp.
71 West 47th St., New York 36, N. Y.

Picco Industries
1729 North Chico Ave., El Monte, Calif.

Precision Founders, Inc.
414 Hester St., San Leandro, Calif.
(nickel and cobalt base)

Rex Precision Products, Inc.
11825 Major St., Culver City, Calif.

Rimer Precision Casting, Inc.
Farnsworth Rd., Waterville, Ohio

Frank Roth Co., Inc.
4280 Park Ave., Bronx, N. Y.

Scott Casting and Manufacturing Co.
Div. of Rolle Mfg. Co., Inc.
3rd St. & Cannon Ave., Lansdale, Pa.

Suffolk Precision Casting Co., Inc.
137 Old Commock, Kings Park, L. I., N. Y.
(monel)

Truecast Precision Casting Co.
133 N. W. 16th St., Boca Raton, Fla.

Truecast Precision Casting Co.
1379 South 7th St., Louisville 8, Ky.

Improve Your
INVESTMENT CASTING
Results!

☆

Let us help you solve your investment casting problems.

☆

Time-tested Ransom & Randolph Investments can save you time and money in the production of consistently accurate castings. They are backed by a half century of leadership in the manufacture of dental casting investments, and more than fifteen years of experience in producing investments for casting all low- and high-melting alloys used in the industrial field.

THE RANSOM & RANDOLPH CO.
TOLEDO 1, OHIO
Established 1872 · Known the world over for products of highest quality

Circle No. **66** on Reader Service Card

CASTING SUPPLY HOUSE
The big "C" in investment castings

- **CONSULTATION** with top technical men
- **CO-OPERATION** in all phases of casting
- **COORDINATION** of supplies and equipment

Meet Robert Greenbaum, President of Casting Supply House, whose 13 years of investment casting industry experience are yours to draw upon. His main aim: to help you find the new equipment and better methods that will result in superior castings.

Meet John Palazzo, casting consultant. Mr. Palazzo will visit your plant, to demonstrate new investment casting methods and will assist you in solving casting problems. He is as close as your nearest phone.

CASTING SUPPLY HOUSE is East Coast Distributor for:

KERR MFG. CO., — Ferrous and Non-ferrous investments

WAI-MET ALLOYS CO. — Shot, Hex Bars and Ingot Steels for ferrous castings.

YATES MFG. CO. — Pattern wax, soluble wax and special shapes.

Price lists and literature available.

CASTING SUPPLY HOUSE
62 West 47th St. • New York 36, N.Y. • JU 6-0290

Circle No. **17** on Reader Service Card

DIE CASTING REPORT

(permanent mold)

Application: *Auto Front Header Casting.*
Problem: *Standardize on mold wash.*
Solution: *'dag'® Dispersion 193—diluted with two parts water; spray-applied.*

RESULT: *CRITICAL CASTING QUALITY ASSURED BY SINGLE MOLD COATING*

The casting involved fits above the windshield on a luxury model convertible. It measures 61" in length, weighs 18 pounds after trimming. 1/16" tolerances must be held in each dimension, with a surface finish of 80 microinches maintained. Many mold coatings, from a variety of sources, were evaluated by Enterprise Brass Works, Muskegon, Michigan, but none proved acceptable. By adopting 'dag' 193 as their mold wash they achieved:

1. "packaged" uniformity — no variation between applications
2. better insulation and release characteristics
3. longer-lasting effectiveness in the mold — up to 300 units, 40 hours of operation, per application

As a guide toward increased effectiveness in your metal casting operations, we invite you to send for your copy of Bulletin No. 425. Address Dept. PMM-61.

ACHESON – First name in solid lubricants for fifty-three years.

ACHESON Colloids Company

PORT HURON, MICHIGAN

A division of Acheson Industries, Inc.

Sales offices in principal cities.

Also Acheson Industries (Europe) Ltd. and affiliates, London, England

Circle No. **2** on Reader Service Card

Bold face listings are advertisers in this issue.

United Refining & Smelting Co.
2920 West Carroll Ave., Chicago, Ill.

Vascoloy-Ramet Corp.
800 Market St., Waukegan, Ill.
(Tantung)

Z & H Manufacturing Co.
Div. of General Casting Corp.
1000 North Division St., Peekskill, N. Y.

EQUIPMENT

CASTING CLEAN-UP EQUIPMENT

Allen Benjamin-Metallugical Specialists
P. O. Box 340, Tempe, Ariz.

British Machines & Foundry Supplies, Ltd.
Clino Div., 80 Shore Rd.
Port Washington, L. I., N. Y.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

National Ultrasonic Corp.
95 Park Ave., Nutley 10, N. J.
(ultrasonic)

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Pangborn Corp.
10 Pangborn Blvd., Hagerstown, Md.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

CASTING EQUIPMENT

Axel Plastics Research Laboratories
41-14 Twenty-Ninth St.
Long Island City 1, N. Y.

Allen Benjamin-Metallurgical Specialists
P. O. Box 340, Tempe, Ariz.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Ecco High Frequency Corp.
7020 Hudson Blvd., North Bergen, N. J.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Manufacturing Instrument & Tool Co.
111 Industrial Rd., E. Clifton, N. J.
(centrifugal)

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

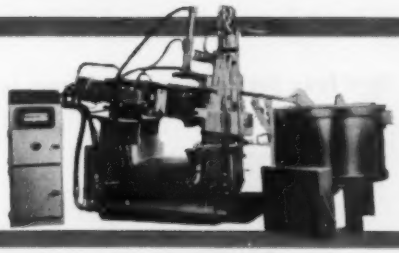
Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Circle 14 ⟶

The revolutionary

DCMT RAM

FULLY AUTOMATIC



The fully automatic DCMT RAM averages 1500 shots per hour... **requires no operator!** 60 ton lock, 1 lb. capacity.

DCMT MAC 99

Automatic Cycling Die Casting Machine

15 Ton • 1 lb. capacity

FIRST TIME...

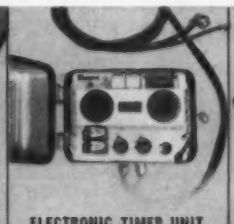
a basic modular Die Casting Machine with plug-in accessories, available at your option for utmost flexibility and efficiency!

FEATURES: push button panel (see below) • **90° convertible die unit** and **removable spacer plate** (see below) • **broader and huskier base** for greater stability and less vibration • **new solenoid-operated valve system** with **speed control** for die setting and shockless cycling • **exhaust mufflers** for quiet operation • Optional features: **electronic timer unit** (see below) for automatic cycling • **a brush device** mounted over the dies, cleans and lubricates the die faces (see below).

B.I.C. ENDORSED QUALITY

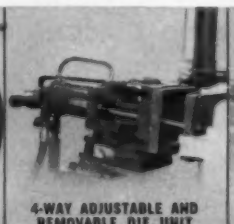
PUSH BUTTON PANEL

Mounted on side of machine away from die parting line. Push buttons for manual cycle and for automatic single cycle. Electrically interlocked for safety.



ELECTRONIC TIMER UNIT

Entirely enclosed in a metal container. Can be attached instantly to the control panel with quick-connect plugs, and be placed away from machine.



4-WAY ADJUSTABLE AND REMOVABLE DIE UNIT

Can be adjusted with tie bars horizontally or vertically. Spacer plate is removed for center gating. These four adjustments provide greater die setting flexibility.

BRUSH DEVICE

Mounted over the dies. Cleans and lubricates the die faces. Phosphor bronze brushes placed in segments for desired adjustment and easy replacement.

DCMT SALES CORP.

Division of British Industries Corp.
Port Washington, N. Y.

DCMT Sales Corp., Dept. DF 1541
Division of British Industries Corp.
Port Washington, N.Y.

Gentlemen:
Please send literature:

- ☐ DCMT MAC 99
- ☐ DCMT RAM

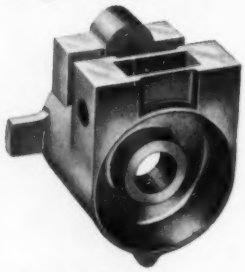
Name:.....

Company:.....

Address:.....

Circle No. 76 on Reader Service Card

Designing a new product?



Investigate Investment Castings

Investment castings offer:

- Large alloy selection
- Flexibility of design
- Lower unit cost
- Integral casting
- Improvement of end casting
- Release of production tools

HARCAST
COMPANY, INC.
622 E. Glenolden Ave., Glenolden, Pa.
Philadelphia Suburbs • LUdlow 6-7114

is
YOUR
PROBLEM
BRASS
?
DIE CASTINGS

Call us now for
complete service
ENGINEERING ASSISTANCE
DIES
PRODUCTION
ZINC • ALUMINUM • BRASS

DIECASTERS, INC.
Closter, New Jersey
Telephones:
POplar 8-5400
N.Y. LAckawanna 4-0320

Circle No. 24 on Reader Service Card

Bold face listings are advertisers in this issue.

Sta-Warm Electric Co.
525 North Chestnut St., Ravenna, Ohio

Unicast Corp.
P. O. Box 325, Yonkers, N. Y.

CRUCIBLES

Ajax-Electrothermic Div.
Ajax-Magnethermic Corp.
Ajax Park, Trenton, N. J.

American Refractories & Crucible Corp.
345 Washington Ave., North Haven, Conn.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Corning Glass Works
Corning, N. Y.

Denver Fire Clay Co.
3037 Blake St., Denver 17, Colo.

Joseph Dixon Crucible Co.
167 Wayne St., Jersey City 3, N. J.

Electro Refractories & Abrasives Corp.
Vars Bldg., 344 Delaware Ave.
Buffalo, N. Y.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Inductotherm Corp.
412 Illinois Ave., Delanco, N. J.

Kerr Mfg. Co.
6081 Twelfth St., Detroit, Mich.

Lava Crucible-Refractories Co.
2408 First National Bank Bldg.
Pittsburgh, Pa.

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Norton Co.
Refractories Div.
1 New Bond St., Worcester 6, Mass.

Ross-Tacony Crucible Co.
Robbins & Milnor Sts., Philadelphia, Pa.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Sherwood Refractories
Div. of H. J. Sherwood, Inc.
16601 Euclid Ave., Cleveland 12, Ohio
(pouring ladles)

Vesuvius Crucible Co.
2216 Palmer St.
Swissvale, Pittsburgh, Pa.

Zirconium Corp. of America
31501 Solon Rd., Solon 39, Ohio

FURNACES & ACCESSORIES

Ajax-Electrothermic Div.
Ajax-Magnethermic Corp.
Ajax Park, Trenton, N. J.

Allen Benjamin-Metallurgical Specialists
P. O. Box 340, Tempe, Ariz.

British Machines & Foundry Supplies, Ltd.
Clino Div.
80 Shore Rd., Port Washington, L. I., N. Y.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Consolidated Vacuum Corp.
1775 Mt. Read Blvd., Rochester 3, N. Y.

Denver Fire Clay Co.
3037 Blake St., Denver 17, Colo.

Despatch Oven Co.
619 S. E. 8th St., Minneapolis 2, Minn.

Detroit Electric Furnace Div.
Kuhlman Electric Co.
11405 East State Fair Ave.
Detroit 34, Mich.

Ecco High Frequency Corp.
7020 Hudson Blvd., North Bergen, N. J.

Electro Refractories & Abrasives Corp.
Vars Bldg., 344 Delaware Ave.
Buffalo, N. Y.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Inductotherm Corp.
412 Illinois Ave., Delanco, N. J.

Kerr Mfg. Co.
6081 Twelfth St., Detroit, Mich.

Lepel High Frequency Laboratories, Inc.
55th St. & 37th Ave., Woodside 77, N. Y.
(high frequency)

Lindberg Engineering Co.
Lindberg-Fisher Div.
2450 West Hubbard Ave., Chicago 12, Ill.

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Norton Co.
Refractories Div.
1 New Bond St., Worcester 6, Mass.

The Ohio Crankshaft Co.
Tocco Div.
3800 Harvard Ave., Cleveland, Ohio

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Schurs Burner & Equipment, Inc.
8956 South Atlantic Ave.
South Gate, Calif.

Sherwood Refractories
Div. of H. J. Sherwood, Inc.
16601 Euclid Ave., Cleveland 12, Ohio

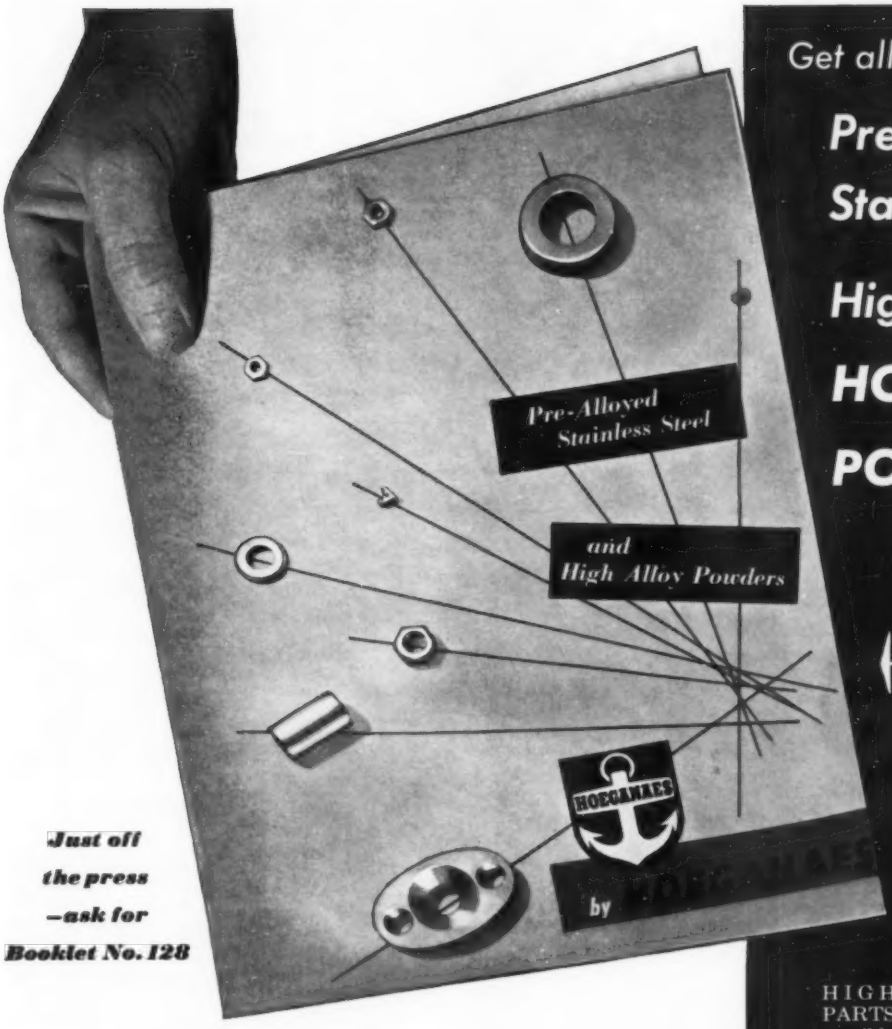
Sta-Warm Electric Co.
525 North Chestnut St., Ravenna, Ohio

F. J. Stokes Corp.
5500 Tabor Rd., Philadelphia 20, Pa.

Surface Combustion
Div. of Midland-Ross Corp.
2375 Dorr St., Toledo 1, Ohio

Unicast Corp.
P. O. Box 325, Yonkers, N. Y.

Vesuvius Crucible Co.
2216 Palmer St., Swissvale, Pittsburgh, Pa.



Get all the facts about

Pre-Alloyed Stainless Steel and High Alloy HOEGANAES POWDERS

. . . they're all here

in this new,

just-off-the-press

HOEGANAES
BOOKLET NO. 128

Just off the press —ask for Booklet No. 128

HIGH ALLOY METAL PARTS FABRICATION is now possible on a low cost production basis thanks to the excellent physicial properties of Hoeganaes High Alloy and Stainless Steel Powders.

Then, too, our research and field engineering staff are available to work with you on your individual requirements . . . with a practical solution in mind. They're as near as your 'phone. Start now by requesting your free copy of booklet No. 128 . . . a copy will be in the return mail.

Here's more helpful free data — HSIC Research Report on 316L Stainless Powder

A 2-page research report on Hoeganaes 316L Stainless Powder; developed to help guide you on the proper processing of this field-tested Stainless Powder.

Graphs show the physical properties you can expect from HSIC 316L under the conditions covered by this report.

Write for your copy today—ask for HSIC Research Report No. 5. A copy will be in the return mail.

HSIC

HOEGANAES

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

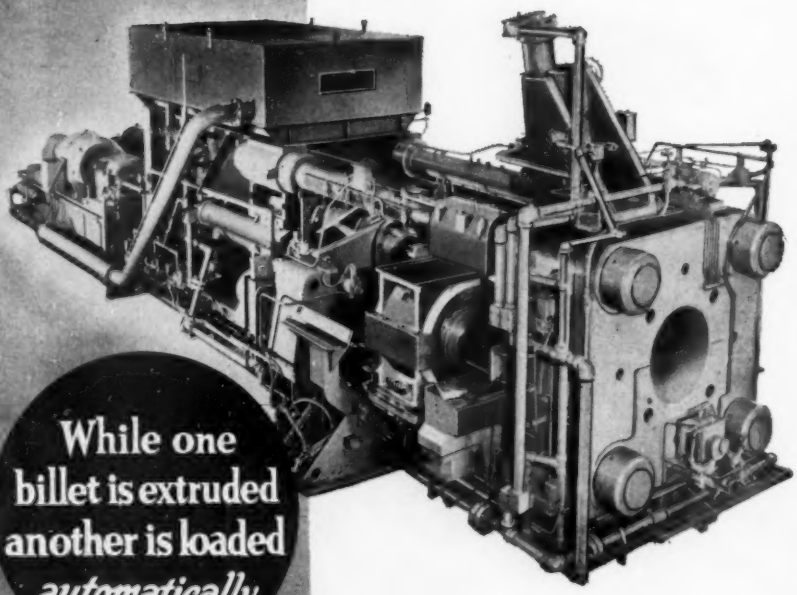
SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Montreal (Canada), Toronto (Canada), Los Angeles, Mexico 16, D. F. (Mexico), Minneapolis, New England (Elmira, N. Y.), Odessa (Texas), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

Circle No. 35 on Reader Service Card

Dead Cycle Time Virtually Eliminated

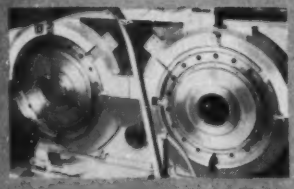
"by YOUNGSTOWN" Presses

with Dual Containers*, Double Die Slide*, Rapid "Rotac" Shear*



While one billet is extruded another is loaded *automatically*

with DUAL CONTAINERS



ALUMINUM · COPPER · BRASS

Flexibility of Die Slide Design permits easy adaptability for extrusion of copper and brass. Auxiliary components enable operator to eject "skulls" from container and to load billets while billets are being extruded.

Double tooling permits cooling without detracting from cycle time.

Properly cooled dies permit higher extrusion speeds. It reduces pickup and produces the ultimate in surface quality.

"Rotac" shears in approximately 2 seconds —¼ the time of conventional butt shear.

Whether your need is for a complete extrusion plant, a new press, auxiliary equipment, or revamping of present equipment, it will pay you to consult a "Y F & M" extrusion engineer.

*Patent Applied For.

The Youngstown Foundry & Machine Co.

Youngstown 1, Ohio

Circle No. 65 on Reader Service Card

Bold face listings are advertised in this issue.

INSPECTION & TESTING EQUIPMENT

Bausch & Lomb Inc.
96161 Bausch St., Rochester 2, N. Y.

Cincinnati Sub-Zero Products, Inc.
3930 Reading Rd., Cincinnati 29, Ohio

Eastman Kodak Co.
Industrial X-Ray Div.
343 State St., Rochester 4, N. Y.
(X-ray films only)

General Electric Co.
X-Ray Dept.
4855 Electric Ave., Milwaukee 1, Wis.

Industrial Overlay Metals, Inc.
Eaton, Ohio

International Research & Development Corp.
6150 Huntley Rd., Worthington, Ohio

Pal Engineering Ltd.
614 First St., S. W., Cedar Rapids, Iowa

Picker X-Ray Corp.
25 South Broadway, White Plains, N. Y.

Projecto-Graph Instruments Corp.
Rochester Hill Rd., Rochester, N. H.

Shannon Luminous Materials Co.
7356 Santa Monica Blvd.
Hollywood 46, Calif.

Sperry Products Co.
Div. of Howe Sound Co.
Danbury, Conn.

The Torsion Balance Co.
35 Monhegan St., Clifton, N. J.

Ullman Devices Corp.
P. O. Box 398, Danbury Rd.
Ridgefield, Conn.

Wilson Mechanical Instrument Div.
American Chain & Cable Co., Inc.
230 Park Ave., New York 17, N. Y.

PATTERN EQUIPMENT

All Metal Precision Casting Corp.
22 School St., Yonkers, N. Y.

Axel Plastics Research Laboratories
41-14 Twenty-Ninth St.
Long Island City 1, N. Y.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

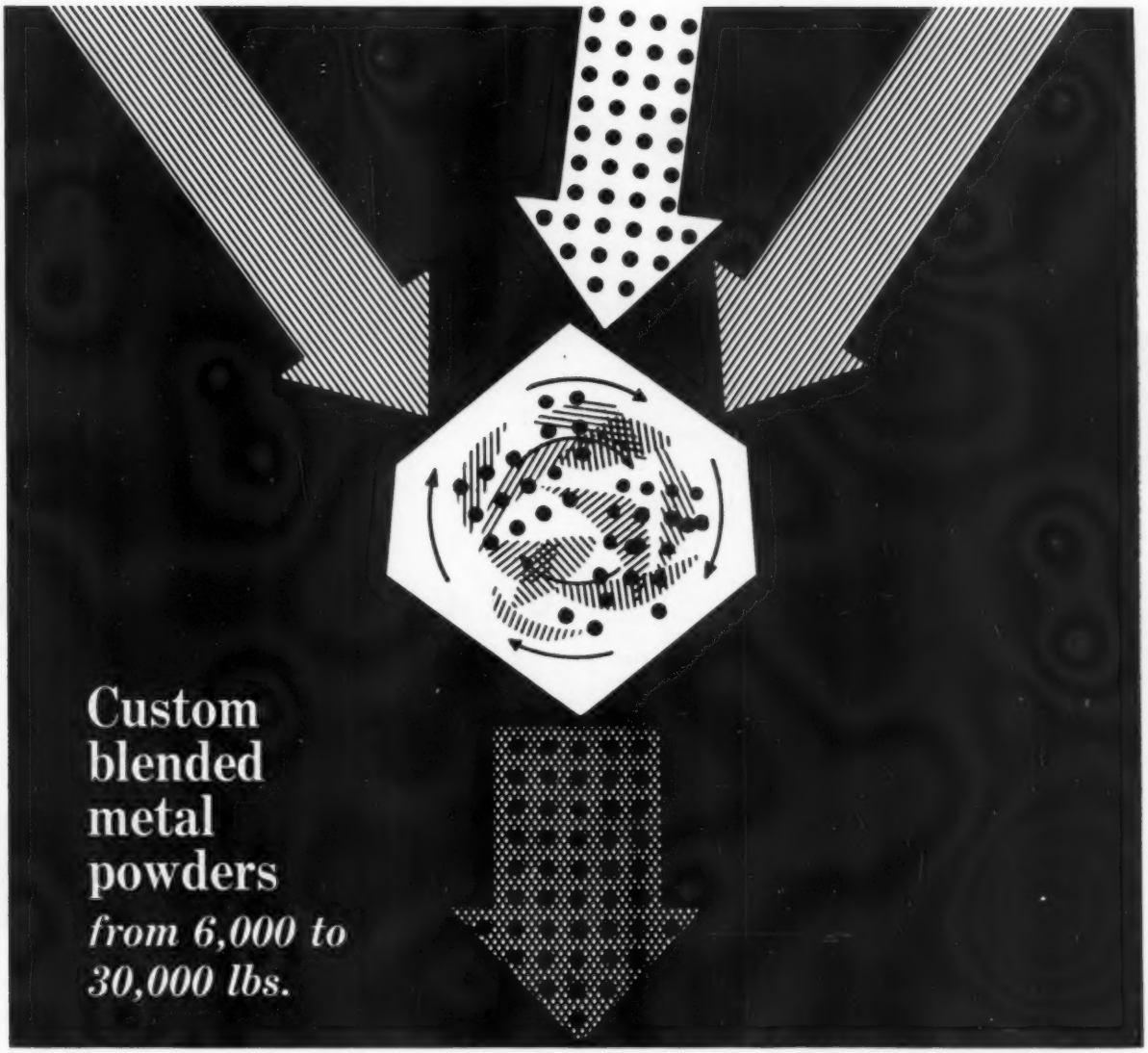
Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Leyden Hydraulics, Inc.
1800 North River Rd., Melrose Park 2, Ill.

Pal Engineering Ltd.
614 First St., S. W., Cedar Rapids, Iowa

Precision Castparts Corp.
4600 S. E. Harney Dr., Portland 6, Oreg.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.



. . . to satisfy your most rigid requirements. At Easton, uniformity and consistency of product is assured and controllable. We custom blend ingredients . . . through close control of particle size distribution, specific apparent densities and flow rates . . . and produce homogeneous, uniform metal powder batches tailor-made to your specifications.

Easton's extensive blending facilities and our years of powder metallurgy experience are your assurance of consistent product quality. A large blender, capable of handling 30,000 lbs. in a single charge, guarantees the complete homogeneity of each truckload lot. And three smaller size blenders of 6,000 lbs. capacity each control the consistency of smaller size quantities.

Fabricators, designers, metallurgists who take advantage of Easton's know-how and facilities are insuring themselves against variation between mixes. At Easton no order is too small or too large. All batches, from small experimental quantities to truckload production lots, are produced with the same careful control of physical and chemical characteristics.

And where high density is desired, Easton's exclusive RZ iron atomizing process offers the "C" Factor: COMPRESSIBILITY . . . CARBON COMPATIBILITY . . . CONSISTENCY.

Those RZ powders ideally suited for premixes are:

Molding Grade Powders

RZ 365	RZ 365 HD
RZ 365 P	RZ 200
RZ 365 S	RZ 4600

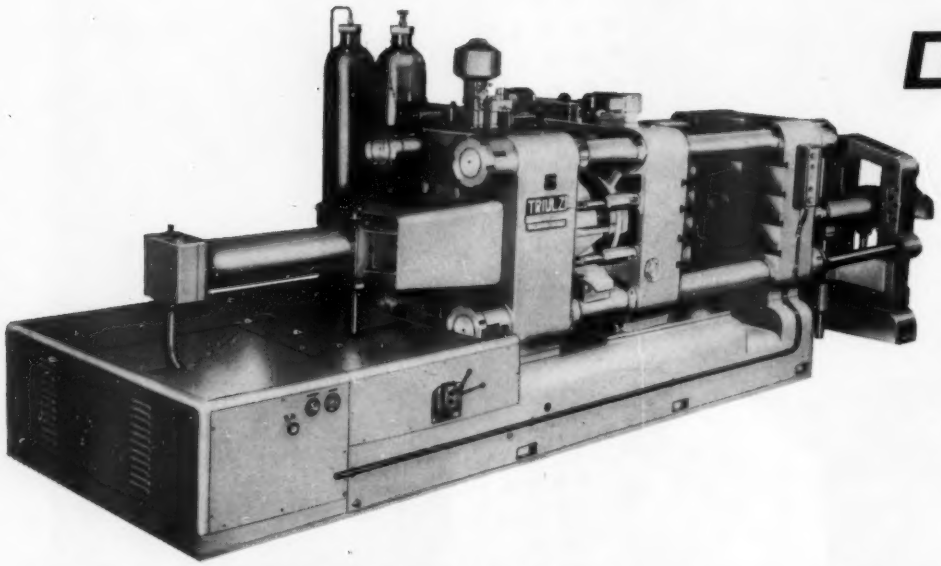
EASTON RZ

EASTON METAL POWDER COMPANY

Division of American Mannex Corporation

900 Line Street, Easton, Pennsylvania • BLackburn 8-6171

Circle No. 5 on Reader Service Card



castmatic

Model 700

cold chamber

- oil hydraulic
- automatic
- platens adjusted by motorized central screw
- schedules pre-selecting panel
- working speeds up to **660 dry cycles per hour**

Characteristics	Mod:	150	500	700	1,000
Max. shot capacity (Al.)	pounds	3.0	11.9	18.7	31.5
locking force	U.S. Tons	165	550	770	1100
Max. Thickness of the die	inches	24	29.5	22	39.5
platens adjustment	inches	14	18	8	20
opening stroke	inches	12	18	26	27.5
dry cycles	per hour	380/550	350/450	250/400	250/360

DIE CASTING MACHINES

- **cold chamber, horizontal and vertical from 135 to 2500 U.S. Tons**
- **hot chamber, from 135 to 1100 U.S. Tons**

A.T.

Novate (Milano)
Italy
Via Vialba, 56
Telephone 3 49 16 61/2/3/4
3 49 17 85/6/7/8
Telegraph TRIULZIPRES
NOVATE
MILANESE

TRIULZI

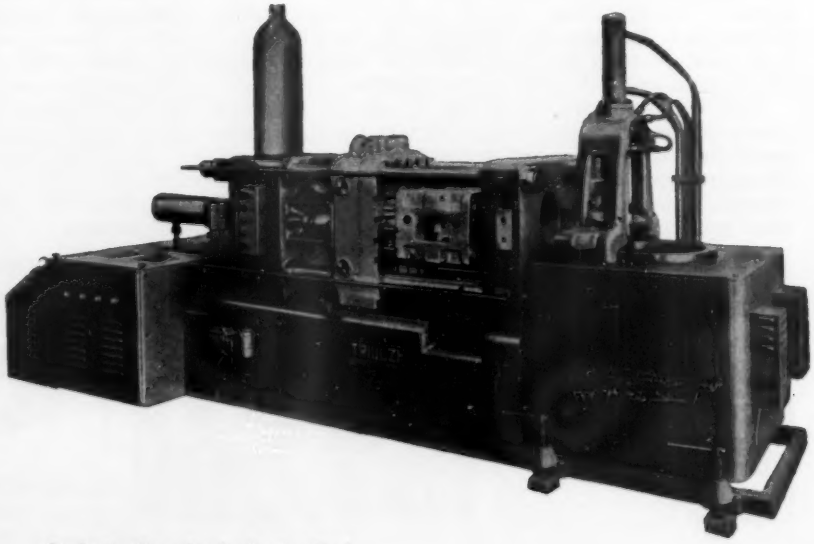
WE ALSO MANUFACTURE:

INJECTION MOULDING MACHINES for thermoplastics
PRESSES for metal sheets and extrusion
PUMPS and water hydraulic plants

Model Z/250

hot chamber

- oil hydraulic
- wedge lock positive clamping
- schedules pre-selecting panel
- working speeds up to **800 dry cycles per hour**

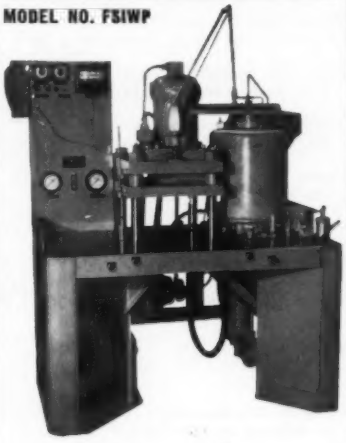


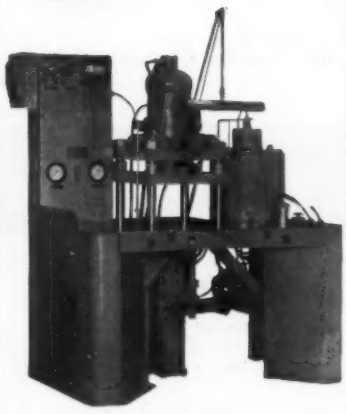
castmatic

Circle No. **61** on Reader Service Card

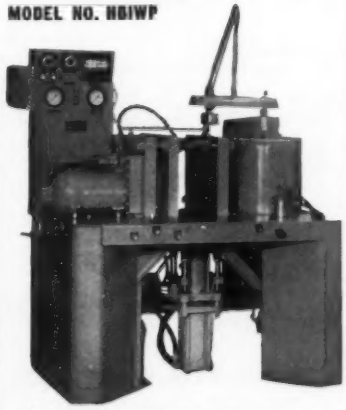
NEW
WAX INJECTORS
3½ lb. CAPACITY ON STANDARD MODELS

MODEL NO. FSIWP





MODEL NO. HBIWP



For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.

1800 North River Rd. • Melrose Park, Ill.

Bold face listings are advertised in this issue.

REFRACTORIES

Ajax-Electrothermic Div.
Ajax-Magnethermic Corp.
Ajax Park, Trenton, N. J.

American Refractories & Crucible Corp.
345 Washington Ave., North Haven, Conn.

The Carborundum Co.
Refractories Div.
Perth Amboy, N. J.

Casting Supply House
62 West 47th St., New York 36, N. Y.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Corning Glass Works
Corning, N. Y.

Denver Fire Clay Co.
3037 Blake St.
Denver 17, Colo.

Joseph Dixon Crucible Co.
167 Wayne St., Jersey City 3, N. J.

Electro Refractories & Abrasives Corp.
Vars Bldg., 344 Delaware Ave.
Buffalo, N. Y.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

A. P. Green Fire Brick Co.
Mexico, Mo.

Harbison-Walker Refractories Co.
307 Fifth Ave., Pittsburgh 22, Pa.

Lava Crucible-Refractories Co.
2408 First National Bank Bldg.
Pittsburgh, Pa.

Norton Co.
Refractories Div.
1 New Bond St., Worcester 6, Mass.

Ross-Tacony Crucible Co.
Robbins & Milnor Sts., Philadelphia, Pa.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Unicast Corp.
P. O. Box 325, Yonkers, N. Y.

Vesuvius Crucible Co.
2216 Palmer St., Swissvale, Pittsburgh, Pa.

Zirconium Corp. of America
31501 Solon Rd., Solon 39, Ohio

VACUUM EQUIPMENT

Axel Plastics Research Laboratories
41-14 Twenty-Ninth St.
Long Island City 1, N. Y.

British Machines & Foundry Supplies, Ltd.
Clino Div.
80 Shore Rd., Port Washington, L. I., N. Y.

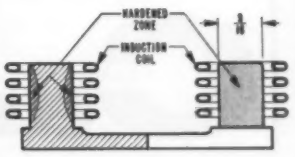
Casting Supply House
62 West 47th St., New York 36, N. Y.

LepeL
HIGH FREQUENCY *Induction* HEATING UNITS

Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

Typical Induction Heating Applications

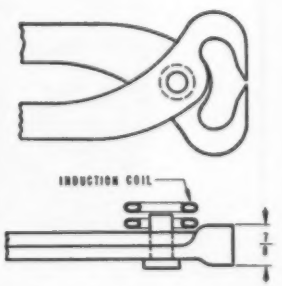
Steel Bosses Selectively Hardened



Bosses on part shown are locally hardened to increase resistance to wear and plastic yielding. Surface hardening by induction provides hardness pattern indicated and hardness of Rc 57/59 for 1040 steel when quenched in water.

Our engineers will process your work samples and return the completed job with full data and recommendations without cost or obligation.

Hot Forming Aids Production Assembly of Nippers



The ends of high-strength steel rivets are selectively heated to 1700° F for hot upsetting. Design of coil permits movement of upsetting tool through the coil.

WRITE FOR NEW LEPEL CATALOG

LepeL HIGH FREQUENCY LABORATORIES, INC.

55th ST. & 37th AVE., WOODSIDE 77, N. Y.
CHICAGO OFFICE: 6246 WEST NORTH AVE.

Circle No. 42 on Reader Service Card

To make the **BEST**...

Begin with the

BEST CASTINGS!

Latrobe Die Casting Co.

Aluminum Alloy Castings

Zinc Alloy Castings

Tin and Lead Alloy Castings

DISTRICT OFFICES

AKRON, OHIO
E. G. Siess, Jr.
227 W. Exchange St.
Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
20001 West Lake Road
Tel: Edison 1-6888

DAYTON, OHIO
J. M. Gallaher
333 W. First St.
Tel: Baldwin 6-3418

DETROIT, MICHIGAN
Jay K. Esler
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thompson
P.O. Box 77
Old Saybrook, Conn.
Tel: Evergreen 8-9833

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Latrobe Die Casting Co.
Latrobe, Pennsylvania

Established 1918

Circle No. 41 on Reader Service Card

Bold face listings are advertisers in this issue.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Cincinnati Sub-Zero Products, Inc.
3930 Reading Rd., Cincinnati 29, Ohio

Consolidated Vacuum Corp.
1775 Mt. Read Blvd., Rochester 3, N. Y.

Ecco High Frequency Corp.
7020 Hudson Blvd., North Bergen, N. J.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Kinney Vacuum Div.
The New York Air Brake Co.
3529 Washington St., Boston 30, Mass.

Lindberg Engineering Co.
Lindberg-Fisher Div.
2450 West Hubbard Ave., Chicago 12, Ill.

NRC Equipment Corp.
160 Charlemont St., Newton, Mass.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

F. J. Stokes Corp.
5500 Tabor Rd., Philadelphia 20, Pa.

MATERIALS

INVESTMENT BINDERS

Anderson Chemical Div.
Stauffer Chemical Co.
Weston, Mich.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Dreifus Steel Corp.
8 Cynwyd Rd., Bala-Cynwyd, Pa.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

R. W. Greeff & Co., Inc.
10 Rockefeller Plaza, New York, N. Y.

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Oil Products Div.
Nalco Chemical Co.
9165 South Harbor Ave., Chicago 17, Ill.

Pre-Vest, Inc.
23420 Lakeland Blvd., Cleveland 23, Ohio

Ransom & Randolph Co.
P. O. Box 905, 324 Chestnut St.
Toledo, Ohio

Riches-Nelson, Inc.
342 Madison Ave., New York 17, N. Y.

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Unicast Corp.
P. O. Box 325, Yonkers, N. Y.

Wasco Laboratories
East Skyline Lake Dr., Wanaque, N. J.

INVESTMENT MATERIALS

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

A. P. Green Fire Brick Co.
Mexico, Mo.

Harbison-Walker Refractories Co.
307 Fifth Ave., Pittsburgh 22, Pa.

Illinois Mineral Co.
Cairo, Ill.

Kerr Mfg. Co.
6081 Twelfth St., Detroit, Mich.

Lava Crucible-Refractories Co.
2408 First National Bank Bldg.
Pittsburgh, Pa.

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

Norton Co.
Refractories Div.
1 New Bond St., Worcester 6, Mass.

Oil Products Div.
Nalco Chemical Co.
9165 South Harbor Ave., Chicago 17, Ill.

Pre-Vest, Inc.
23420 Lakeland Blvd., Cleveland 23, Ohio

Ransom & Randolph Co.
P. O. Box 905, 324 Chestnut St.
Toledo, Ohio

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Unicast Corp.
P. O. Box 325, Yonkers, N. Y.

Wasco Laboratories
East Skyline Lake Dr., Wanaque, N. J.

Zirconium Corp. of America
31501 Solon Rd., Solon 39, Ohio

PATTERN MATERIALS

American Smelting & Refining Co.
Federated Metals Div.
120 Broadway Ave., New York, N. Y.

Apex Smelting Co.
2537 West Taylor St., Chicago 12, Ill.

M. Argueso & Co., Inc.
441 Waverly Ave., Mamaroneck, N. Y.

Axel Plastics Research Laboratories
41-14 Twenty-Ninth St.
Long Island City 1, N. Y.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.

Corning Glass Works
Corning, N. Y.
(preformed cores)

DIAL IN ON GREATER TEMPERATURE CONTROL ACCURACY!

"Pin-point" accuracy is at your fingertips with West's new tubeless, solid-state digital set point controllers. By adjusting the 3-digit, 1000-unit dial, the control point can be set in increments (depending on range) as small as ½°. Null balance circuit provides exceptional sensitivity . . . closer than ¼° with most thermocouples.

Calibration is not affected by leadwire length. Continuous cold junction compensation is provided electrically. Repeatability, linearity and resolution are excellent.

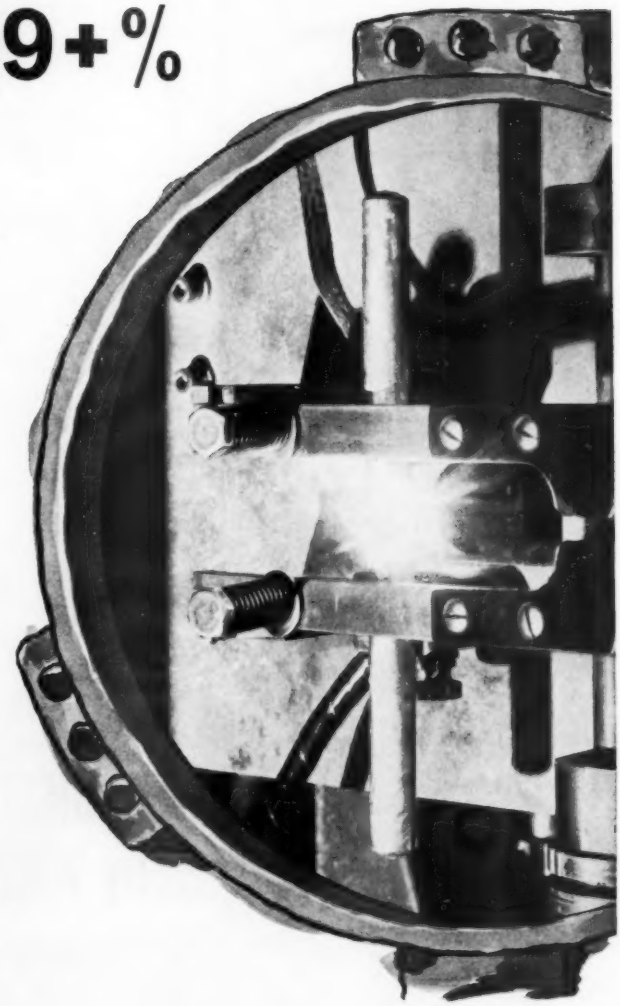
These compact units may be panel or surface-mounted. Available in on-off, proportioning and stepless (saturable core reactor) control modes . . . one, two or three ranges can be provided. For full details, write for Bulletin JY.

NEW DIGITAL SET POINT CONTROLLERS ...by WEST

WEST Instrument CORPORATION
SALES OFFICES IN PRINCIPAL CITIES
FACTORY AND GENERAL OFFICES
4357-D W. MONTROSE, CHICAGO 41, ILL.
BRITISH SUBSIDIARY
WEST INSTRUMENT, LTD.
52 Regent St., Brighton 1, Sussex

Circle No. 64 on Reader Service Card

22,500 VOLT "SEARCHLIGHT" Constantly Watches ST. JOE 99.99+% ZINC QUALITY



A blazing high voltage arc which illumines the composition of metal is part of the modern scientific equipment St. Joe uses to insure unvarying zinc purity.

Samples of every heat of St. Joe zinc are analyzed by the Direct Reading Spectrometer. The samples are placed in the Spectrometer electrode holders and the extremely high voltage creates an arc between them. As elements are vaporized, light from the arc is broken into element lines of varying light energy.

This energy, directed to photomultipliers (photosensitive electronic tubes), is converted to electrical energy which actuates precalibrated dials (see photo) that indicate elements directly IN PERCENTAGES! In five minutes the zinc sample can be completely analyzed for iron, lead, cadmium, copper, aluminum, indium, tin, antimony, silicon and magnesium. Two minutes later, casting room operators know whether or not they are holding critical purity specifications.

Stringent, continuous quality control backed by St. Joe's reputation as a supplier of quality metal is your assurance of consistent die casting results from St. Joe 99.99+% zinc.

ST. JOSEPH LEAD CO.

250 Park Avenue • New York 17, New York

ST. JOE 99.99+% ZINC

ZN-100

Bold face listings are advertisers in this issue.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

J. I. Holcomb Mfg. Co.
Research Lab.
4401 Cold Spring Rd., Indianapolis, Ind

Kish Resin Western Sales, Inc.
125 West Verduga Ave., Burbank, Calif.

Pal Engineering Ltd.
614 First St., S. W., Cedar Rapids, Iowa

Perma-Flex Mold Co.
1919 East Livingston Ave.
Columbus, Ohio

Alexander Saunders & Co., Inc.
95 Bedford St., New York, N. Y.

Scientech Co.
P. O. Box 511, Independence, Kans.

Sherwood Refractories
Div. of H. J. Sherwood, Inc.
16601 Euclid Ave., Cleveland 12, Ohio
(preformed ceramic cores)

United Refining & Smelting Co.
2920 West Carroll Ave., Chicago, Ill.

Wasco Laboratories
East Skyline Lake Dr., Wanaque, N. J.

Yates Mfg. Co.
340 West Huron, Chicago, Ill.

METALS & ALLOYS

FERROUS

Alloy Metal Products, Inc.
2333 Rockingham Rd., Davenport, Iowa

Austenal Co.
Div. of Howe Sound Co.
Microcast Products
230 Park Ave., New York 17, N. Y.

Cannon-Muskegon Corp.
2875 Lincoln St., Muskegon, Mich.

Dreifus Steel Corp.
8 Cynwyd Rd., Bala-Cynwyd, Pa.

Dick Ells Co.
908 Venice Blvd., Los Angeles 15, Calif.

Haynes Stellite Co.
Div. of Union Carbide Corp.
1020 West Park Ave., Kokomo, Ind.

Vanadium-Alloys Steel Co.
Rezak Ave., Latrobe, Pa.

WaiMet Alloys Co.
5320 Oakman Blvd., Dearborn 2, Mich.

Westinghouse Electric Corp.
Metals Plant, P. O. Box 128, Blairsville, Pa.

M. A. Young & Co.
Ohio Edison Bldg., P. O. Box 1048
Youngstown 3, Ohio

NON-FERROUS

Alloy Metal Products, Inc.
2333 Rockingham Rd., Davenport, Iowa

Alloys & Chemicals Corp.
4365 Bradley Rd., S. W., Cleveland, Ohio

Aluminum Smelting and Refining Co., Inc.
5463 Dunham Rd., Maple Heights 37, Ohio

American Metal Climax, Inc.
Amco Div.
1270 Ave. of the Americas
Rockefeller Center, New York 20, N. Y.

American Smelting & Refining Co.
Federated Metals Div.
120 Broadway Ave., New York, N. Y.

Apex Smelting Co.
2537 West Taylor St., Chicago 12, Ill.

Belmont Smelting & Refining Works, Inc.
330 Belmont Ave., Brooklyn, N. Y.

The Beryllium Corp.
Tuckerton Rd., P. O. Box 1462
Reading, Pa.

The Brush Beryllium Co.
5209 Euclid Ave., Cleveland 3, Ohio

Cannon-Muskegon Corp.
2875 Lincoln St., Muskegon, Mich.

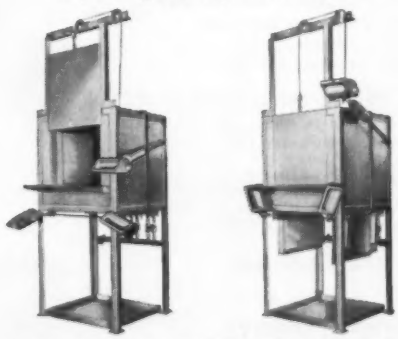
Cerro Sales Corp.
300 Park Ave., New York 22, N. Y.

Dreifus Steel Corp.
8 Cynwyd Rd., Bala-Cynwyd, Pa.

New SAUNDERS
Shell Investment Mold FURNACE

. . . provides maximum operator convenience
. . . occupies minimum floor space

Gas fired to 1800°F. — equipped with Indicating Pyrometer —
Counter-weighted Front and Drop-Bottom Trapdoors —
Occupies just 46" x 46" of Floor Space —
Ample Firing Chamber, 18" x 18" x 18"



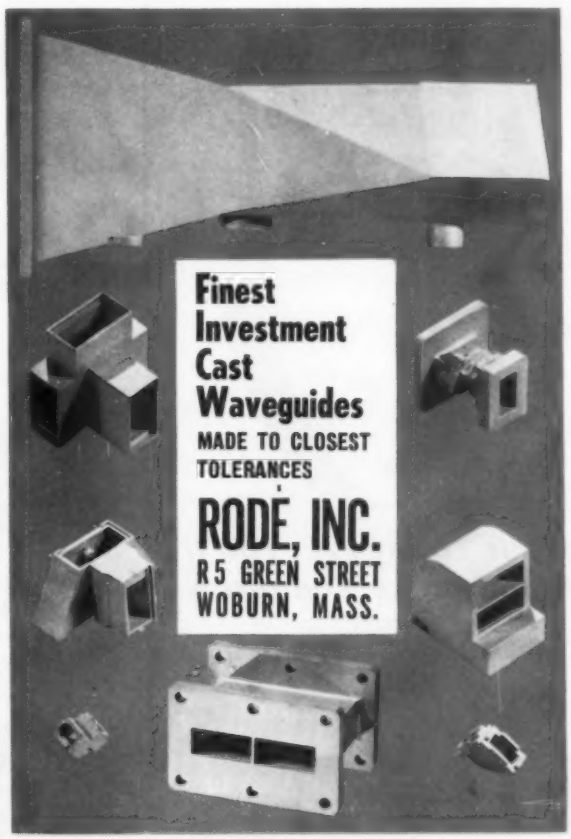
Front door raised to load shell investment molds for firing. Cable and pulley counter-weight mechanism built close to side wall.

Side-hinged trapdoors lowered to let molten wax run into water filled collecting pan.

Write Today For Information!

Alexander Saunders & CO., INC.
95 Bedford Street, New York 14, N. Y.

Circle No. **55** on Reader Service Card



Circle No. **77** on Reader Service Card

HARDENED STEEL DIE CASTING PLUNGER RINGS by AUTO DIESEL

1" dia. x ⅛" and up

Cut die cast production costs — reduce downtime with rings made by the world's quality ring manufacturer. The hardened steel ring illustrated is resistant to heat and abrasion. Other Auto Diesel products custom manufactured to your specific requirements.

1. Rings of all materials for industrial purposes.
2. Plungers for zinc.
3. Plunger tips and rings for aluminum.

Try it Today . . . . You'll Standardize Tomorrow

THE AUTO-DIESEL PISTON RING CO.
3141 Superior Avenue • Cleveland 14, Ohio

Circle No. **12** on Reader Service Card

Bold face listings are advertisers in this issue.

Foote Mineral Co.
18 West Chelten Ave.
Philadelphia 44, Pa.

Haynes Stellite Co.
Div. of Union Carbide Corp.
1020 West Park Ave., Kokomo, Ind.

The International Nickel Co., Inc.
67 Wall St., New York 5, N. Y.
(nickel)

Sherritt Gordon Mines, Ltd.
Fort Saskatchewan, Alberta, Can.
(nickel, cobalt and composite powders, nickel-aluminum, nickel-graphite and nickel-phosphorus as powders)

United Refining & Smelting Co.
2920 West Carroll Ave., Chicago, Ill.

U. S. Reduction Co.
4610 Melville Ave., P. O. Box 30
East Chicago, Ind.

Vanadium-Alloys Steel Co.
Rezak Ave., Latrobe, Pa.

WaiMet Alloys Co.
5320 Oakman Blvd., Dearborn 2, Mich.

M. A. Young & Co.
Ohio Edison Bldg., P. O. Box 1048
Youngstown 3, Ohio

MISCELLANEOUS METALS

Alloy Metal Products, Inc.
2333 Rockingham Rd., Davenport, Iowa

American Metal Climax, Inc.
Amco Div.
1270 Ave. of the Americas
Rockefeller Center, New York 20, N. Y.

American Smelting & Refining Co.
Federated Metals Div.
120 Broadway Ave., New York, N. Y.

Centrifugal Casting Supply Co.
17 West 60th St., New York 23, N. Y.
(soft metals)

Foote Mineral Co.
18 West Chelten Ave., Philadelphia 44, Pa.
(lithium, manganese, nitrided manganese)

Niranium Corp.
10-25 Forty-Fourth Ave.
Long Island City 1, N. Y.

L. E. Simmons Refining Co.
440 North Orleans St., Chicago 10, Ill.

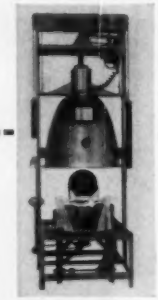
United Refining & Smelting Co.
2920 West Carroll Ave., Chicago, Ill.

Vanadium-Alloys Steel Co.
Rezak Ave., Latrobe, Pa.

WaiMet Alloys Co.
5320 Oakman Blvd., Dearborn 2, Mich.

Westinghouse Electric Corp.
Metals Plant
P. O. Box 128, Blairsville, Pa.

M. A. Young & Co.
Ohio Edison Bldg., P. O. Box 1048
Youngstown 3, Ohio
(nickel, chrome, cobalt, tungsten, molybdenum, titanium)



Everything for Casting

MANUFACTURERS OF "3C" PRODUCTS

- **VACUUM MIX and POUR**
  For complete investing procedure in one operation — while under Vacuum.
  ask for Bulletin 1259
- **HIGH PRESSURE WATER GUN**
  For removal of investment from castings
  ask for Bulletin 1258

- **AUTOMATIC INDUSTRIAL INJECTOR**
  For injecting wax or plastics.
  ask for Bulletin 120
- **QUICK-ACTING ADJUSTABLE CLAMPS**
  For greater speed of operation.
  ask for Bulletin 1202
- **CASTING MACHINES**

SUPPLIERS OF

WHIP-MIX INVESTMENTS

- Ferrotex
- Cristobalite
- Chemitex
- Corvest

"3C" PLASTICS

CENTRIFUGAL CASTING SUPPLY CO.
17 WEST 60th STREET • NEW YORK 23, N. Y.

Circle No. **19** on Reader Service Card

PMM

opportunities

jobs and equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Road, Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITION OPEN

INVESTMENT CASTING TECHNICIANS

Nation's largest jobbing foundry has several openings for investment casting technicians.

Experience in investment technique, engineering and metallurgy is a basic requirement. The ability and experience to accept and solve technical casting, gating and designing problems is of prime importance.

These are key positions with our company and candidates who are accepted will receive excellent salary proposal, commensurate with their experience and ability.

This is an outstanding opportunity. All replies confidential. Our employees know of this ad. Box 6361.

WANTED: Sales Representative for an Eastern Custom Die Casting Company, producers of aluminum & zinc pressure and vacuum die castings. Must have substantial sales following, at least $150,000.00 per year, covering the New England area. Good opportunity for right man. Submit resume to Box 6161.

REPRESENTATIVE WANTED: Progressive eastern zinc die casting producer wants representatives to cover the following territories: New England states, New York and Pennsylvania. Commission basis. Please reply to Box 6261.

EQUIPMENT

HERE'S A REAL BUY. BT800 cold chamber casting machine—18 months old—used only 6 months. Price exceptionally reasonable. Box 6461.

WANTED—Used DIE CAST MACHINES and secondary equipment of any type. Iron Machinery Co., 400 East 142nd St., Dolton, Illinois.

Circle No. 44 on Reader Service Card

POWDER CONDITIONING AND PROCESSING

METALLIC AND NON-METALLIC POWDERS GROUND TO YOUR SPECIFICATIONS

- IRON POWDER
- FERRO PHOSPHOROUS
- FERRITES
- MILL SCALE
- COPPER
- TUNGSTEN
- COBALT
- NON-METALLICS
- SOLID CHEMICALS

SCREENING AND PARTICLE SIZE CLASSIFICATION

OPEN TIME AVAILABLE

MICRO METALS CORPORATION

99 President St. Passaic, N. J.
Dept. No. 3A
Member Metal Powder Ind. Fed.

A Free Sample FOR TESTING

Prove for yourself, in your own plant, the superior quality of P-V Investment. For a sample for testing, write today telling us your requirements.

Close control at every step in our production assures you of better, more consistent workmanship. Accurate details, fine surfaces and complete filling of molds are the rule, when you make your castings in P-V Investments.

Tons of P-V Investments are used daily by leading precision casters using the expendable pattern method. Technical advice on your investing problems is available.

Prompt shipment can be made from our modern plant. And P-V Investments are *priced right!* Write, wire or phone for this sample, prices and additional information.

PRE-VEST inc.
23420 LAKELAND BLVD.
CLEVELAND 17, OHIO

Circle No. 74 on Reader Service Card

POWDER METALLURGIST/CERAMIST

TAPCO's expanding Materials Department has openings on its staff for engineers experienced in high temperature materials, both metals and ceramics.

Work history must include planning and conducting of programs on dispersion strengthened refractory metals, high temperature ceramics, cermets, or refractory compounds for missile propulsion systems applications. Degree plus five years' related experience or equivalent.

Send your resume to or contact Mr. R. J. Theibert, Technical Staffing Manager, at the address below.

TAPCO GROUP
Thompson Ramo Wooldridge Inc.
23555 EUCLID AVENUE
CLEVELAND 17, OHIO

PMM index of advertisers

A

Abbott Ball Co., The 58
Acheson Colloids Co. 86
Alan Wood Steel Co. 59
Almco, Queen Products Div., King-Seeley Corp. 51
Aluminum & Magnesium, Inc. 2
Aluminum Smelting & Refining Co. ..... Cov. II
American Mannex Corp., Easton Metal Powder Div. 91
American Refractories & Crucible Corp., The 4
American Sinterings 64
American Smelting & Refining Co., Federated Metals Div. 11
American Smelting & Refining Co., Levelmax 55
American Zinc Sales Co. 14
Apex Smelting Co. ..... Cov. IV
Asco Sintering Corp. 57
Arwood Corp. 74
Atlantic Casting & Eng. Corp. 44
Auto Diesel Piston Ring Co., The 98

B

B & T Machinery Co. 33
British Industries Corp., DCMT Div. .. 87
Brown Boveri Corp. 38

C

Cannon-Muskegon Corp. 6
Carborundum Co., The Electro Minerals Div. 46
Carborundum Co., The, General Refractories 37
Casting Engineers, Inc. 50
Casting Supply House 85
Cast-Master, H-P-M Div. 1
Centrifugal Casting Supply Co. 98
Certified Alloys Co. ..... Cov. II
Cratex Mfg. Co., Inc. 56
Crucible Steel Co. of America 19

D

Denver Fire Clay Co. 77
Detroit Mold Engineering Co. 76
Diecasters, Inc. 88
Diecraft Tool Co. 65
Dodge Steel Co. 18
Dollin Corp. 36
Dow Corning Corp. 68

E

Efficient Tool & Die Co., The 8-9

F

Filtros, Inc. 82

G

Grafo Colloids Corp. 37
Gries Reproducer Corp. 57

H

Harcast Investment Castings 88
Haviland Products Corp. 56
C. I. Hayes, Inc. 64
Hitchiner Mfg. Co. 18
Hoeganaes Sponge Iron Corp. 89
Hoover Co., The ..... Cov. III
H-P-M Div., Koehring Corp. 1

I

Independent Steel Casting Co. 77
Intn'l Minerals & Metals Corp. 100
Investment Casting Co. 79
Investment Casting Institute 72

K

Kerr Mfg. Co. 78
Kux Machine Co. 52

L

Latrobe Die Casting Co. 94
Lepel High Frequency Labs, Inc. 93
Lester-Phoenix, Inc. 7
Leyden Hydraulics, Inc. 93
Lindberg Engineering Co. 17

M

Micro Metals Corp. 99
Midwest Precision Castings Co. 82
Milwaukee Die Castings Co. 66
Misco Precision Casting Co. 84

N

National Lead Co., Metal Sales Div. 16
New England Die Casting 22
New Jersey Zinc Co., The 62-63

O

Oakite Products, Inc. 54
Olin Mathieson Chemical Corp. 5

P

Pierce-Waller, Inc. 66
Precision Founders, Inc. 67
Pre-Vest, Inc. 99

R

Ransom & Randolph Co., The 85
Reese Metal Products Corp. 66
Rode, Inc. 97

S

Alex. Saunders & Co., Inc. 97
Sherritt Gordon Mines, Ltd. 83
H. J. Sherwood, Inc. 80
So. Diecasting & Engineering Corp. .. 12
St. Joseph Lead Co. 96
F. J. Stokes Corp. 13
Superior Industries, Inc. 60

T

Tiffin Foundry Co., The 65
A. Triulzi 92

U

Union Steel Products Co. 75
United International Research 57

V

Vanadium-Alloys Steel Co. 81
Vascoloy-Ramet Corp. 20

W

West Instrument Corp. 95

Y

Yates Mfg. Co. 78
Youngstown Foundry & Machine Co., The 90

HUDSON BAY

SLAB ZINC 99.99+%

A QUALITY PRODUCT WHICH MEETS THE MOST EXACTING REQUIREMENTS OF THE DIE CASTING INDUSTRY

INTERNATIONAL MINERALS and METALS CORPORATION

11 BROADWAY • NEW YORK 4, N.Y.

Circle No. 38 on Reader Service Card

If it's service you're after..

call a Hoover Man

If you want the kind of service featured in this cartoon, we aren't making any promises. But if you want service in quality aluminum and zinc alloy castings, you'll come to the right place if you come to Hoover. We've been satisfying the die-casting demands of many different industries for 35 years. Let one of our Sales Engineers tell you about us. Why not today?

THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio Die Casting specialists since 1922

In Canada — Hamilton, Ontario

DIE CASTING *by* HOOVER

Circle No. 36 on Reader Service Card

Her housework's a breeze with appliances made of APEX

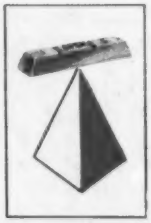
ALUMINUM

Today's homemaker manages a neat, well-run household and still enjoys a full share of leisure time—with a big assist from aluminum and its modern, work saving applications.

She finds new convenience with aluminum pans and utensils that protect the taste of food, clean easily, heat quickly and evenly . . . she benefits from the better operation that strong, durable aluminum cast parts bring to her electric iron, vacuum cleaner, electric grill and scores of other appliances.

Apex and its metallurgists work closely with the foundries and die casters who serve the appliance industry. Custom and standard aluminum alloys, produced by Apex to rigid specifications, provide the performance and quality you want in these modern day work savers.

Research leadership back of every ingot



Warehouse distributor of ALCAN foundry alloy ingot

APEX SMELTING COMPANY

Producers of ALUMINUM, MAGNESIUM AND ZINC ALLOYS

CHICAGO 12 CLEVELAND 5 LONG BEACH 10, CAL.

SPRINGFIELD, OREGON (National Metallurgical Corp.)

Circle No. **10** on Reader Service Card

Your products may also be produced better and more efficiently with the help of aluminum castings. Apex Smelting and the companies it serves in the die casting and foundry industry stand ready to assist you and your engineers.